



# Work Package 2: Climatic & Agricultural Data

**2<sup>nd</sup> General Meeting**

10<sup>th</sup>-12<sup>th</sup> November 2017

**Raül Marcos**

Coordinators and developers of BSC tasks  
PostDoc Researchers – Nube González –Albert Soret  
Barcelona Supercomputing Centre, [raul.marcos@bsc.es](mailto:raul.marcos@bsc.es)



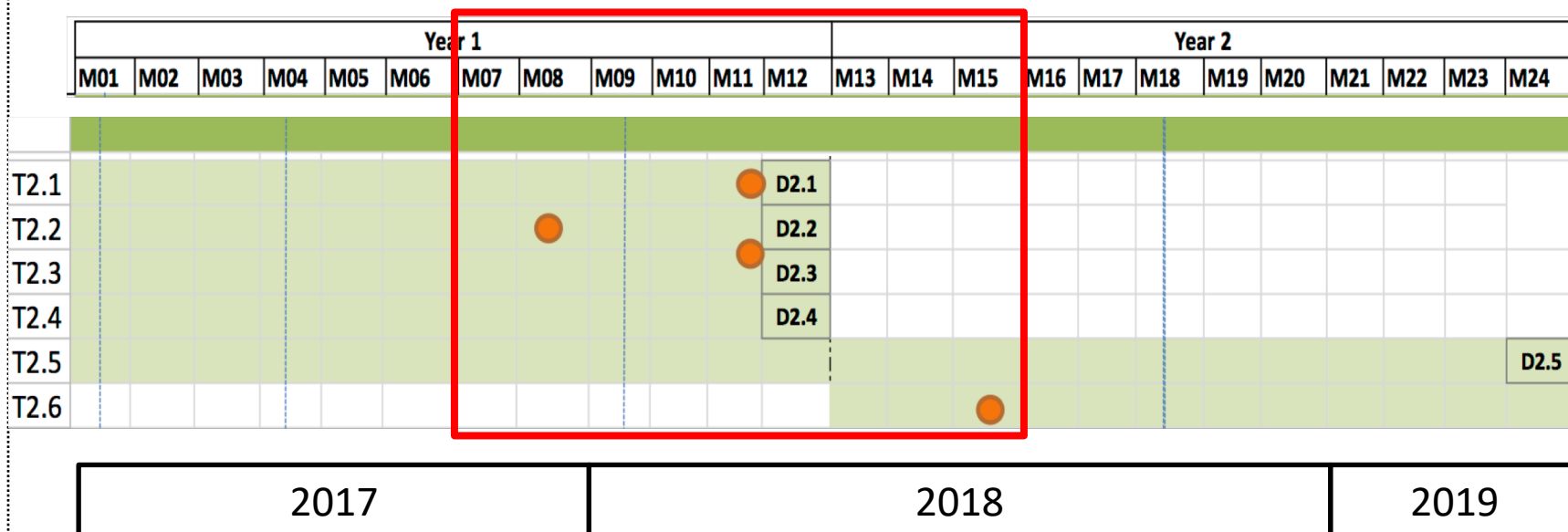
*This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 730253.*

## Main objectives of WP2

- **Implementation of bias corrected seasonal predictions**
- **Monthly production of seasonal predictions**
- **Deployment of the operational weather forecast events system (e.g. for extremes)**
- **Production of decadal projections for the 3 different regions considered in the project**
- **Implementation of calibrated models for the prediction of plant phenology and yield.**
- **Implementation of calibrated irrigation models for the prediction of annual water requirements.**

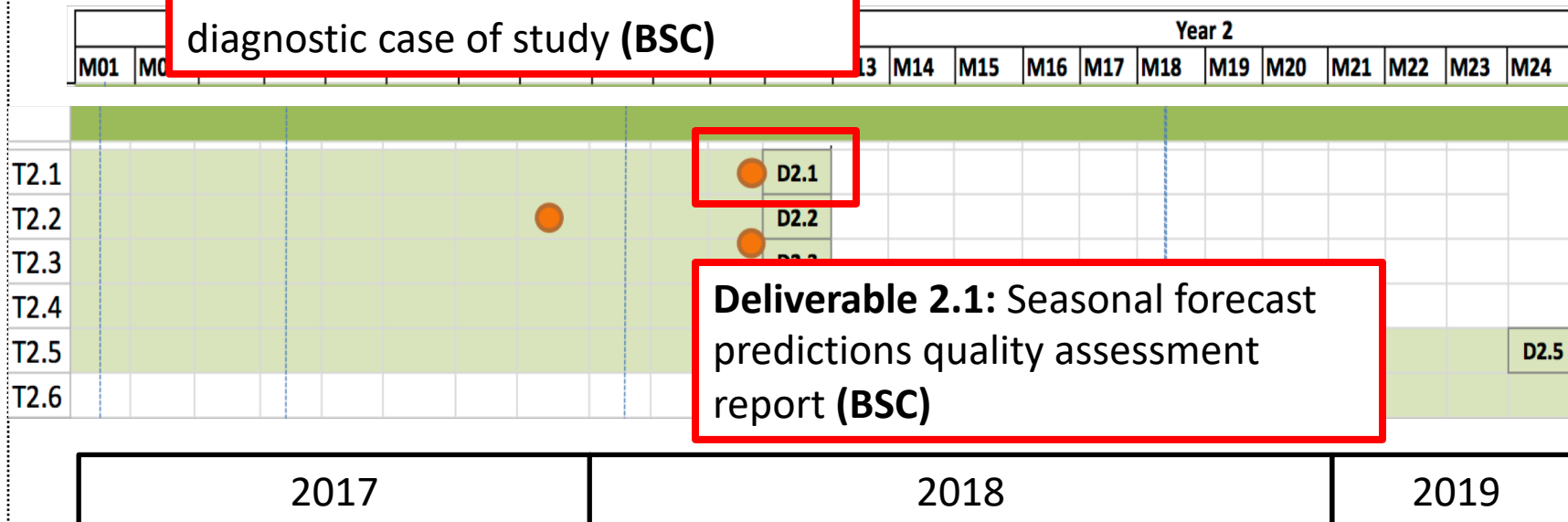


## Gantt Diagram of WP2. What have we done?

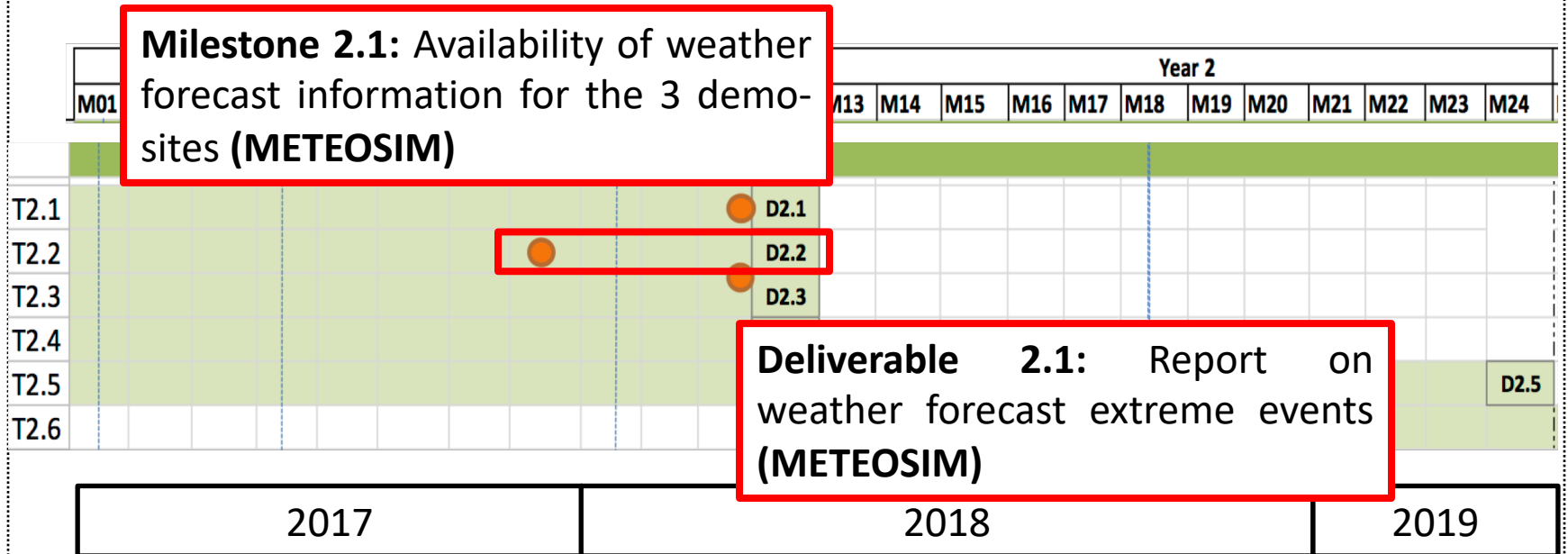


## Gantt Diagram of WP2

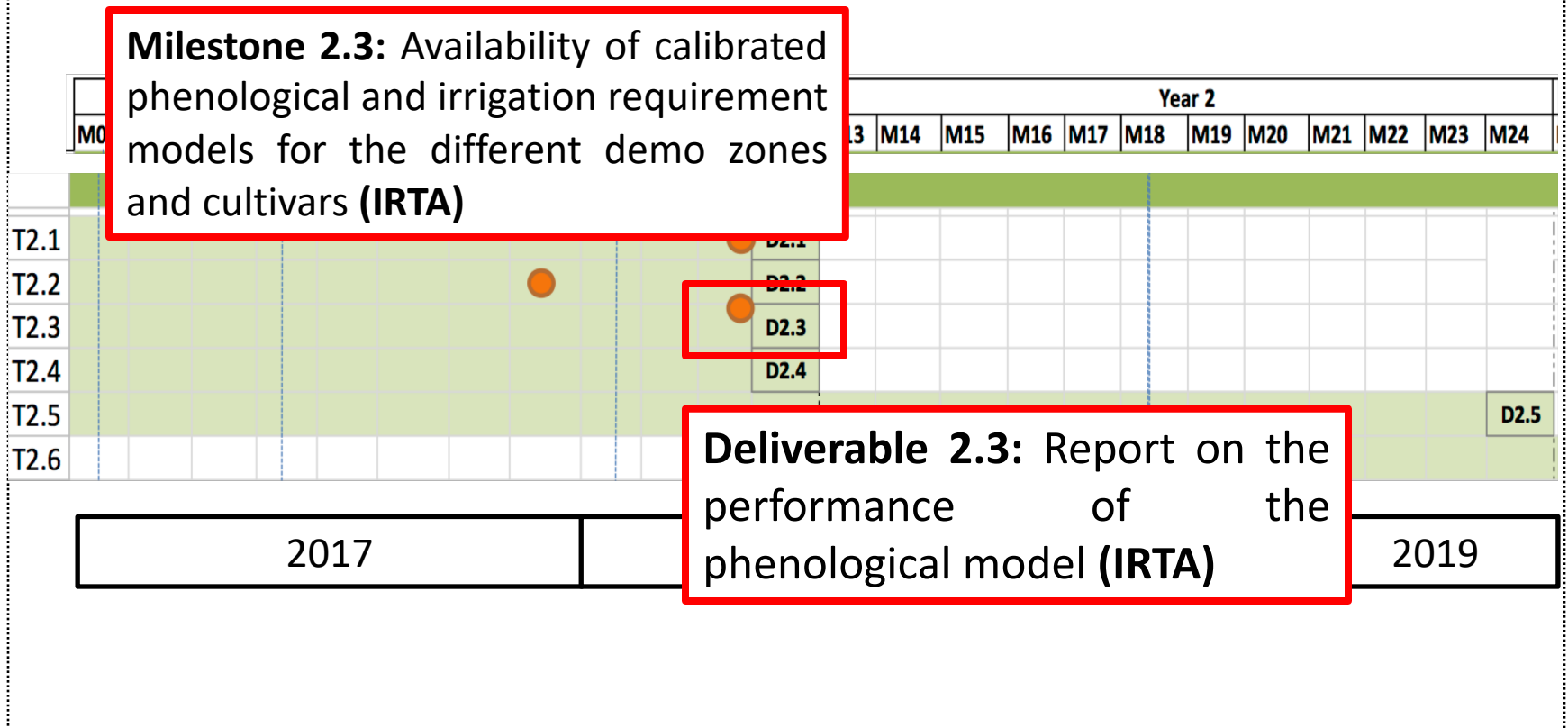
**Milestone 2.2:** Availability of seasonal forecast simulations for the diagnostic case of study (BSC)



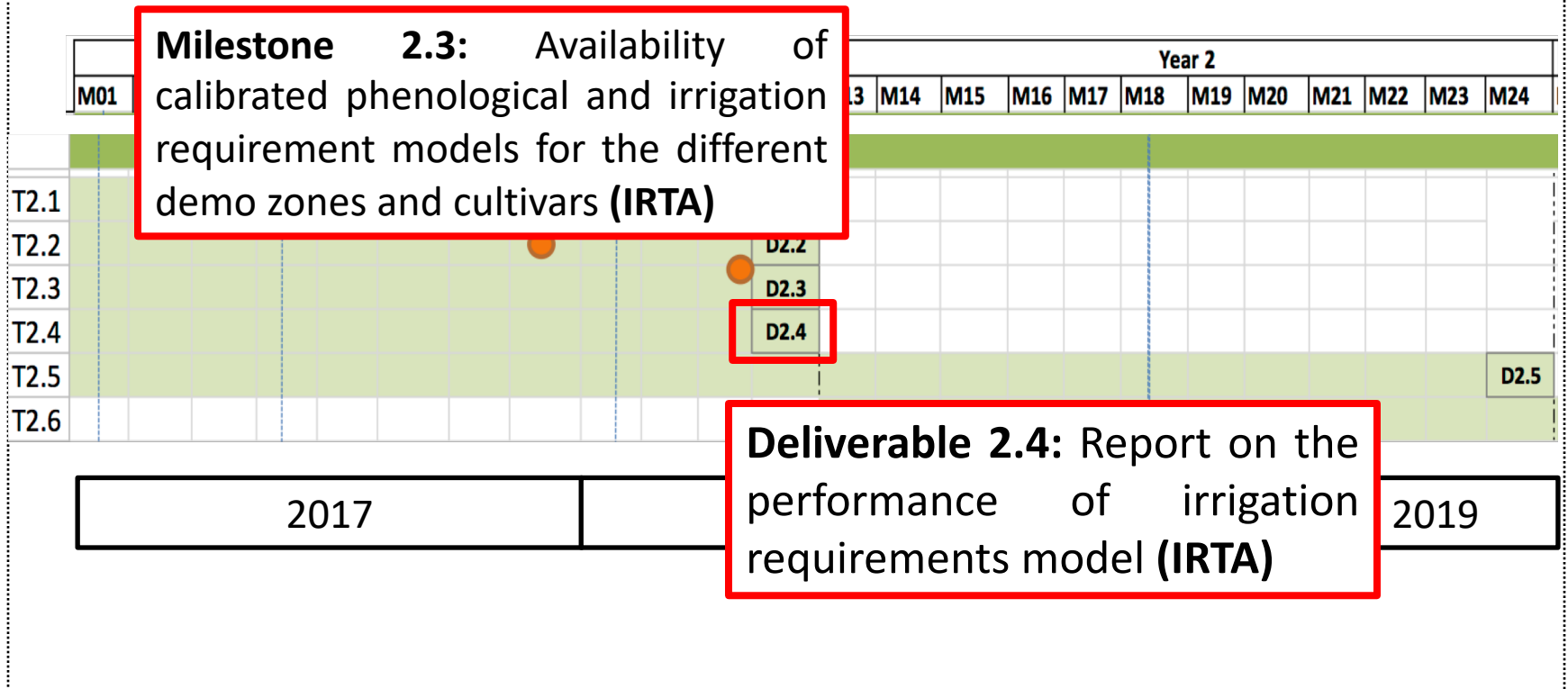
## Gantt Diagram of WP2



## Gantt Diagram of WP2

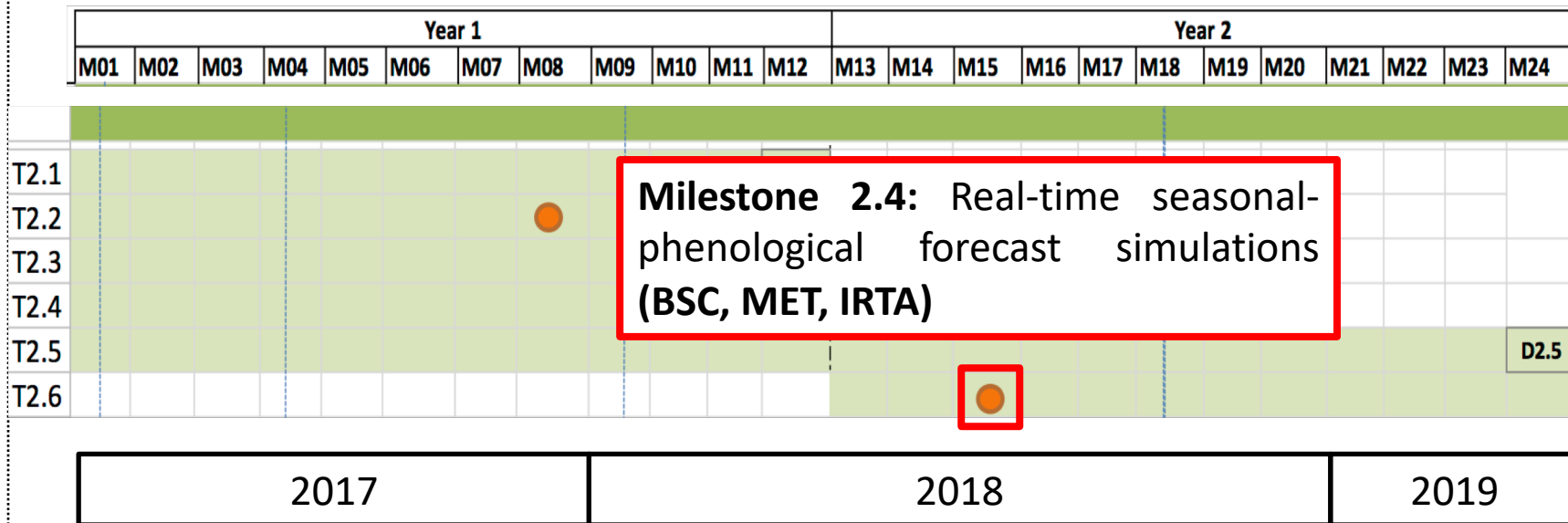


## Gantt Diagram of WP2

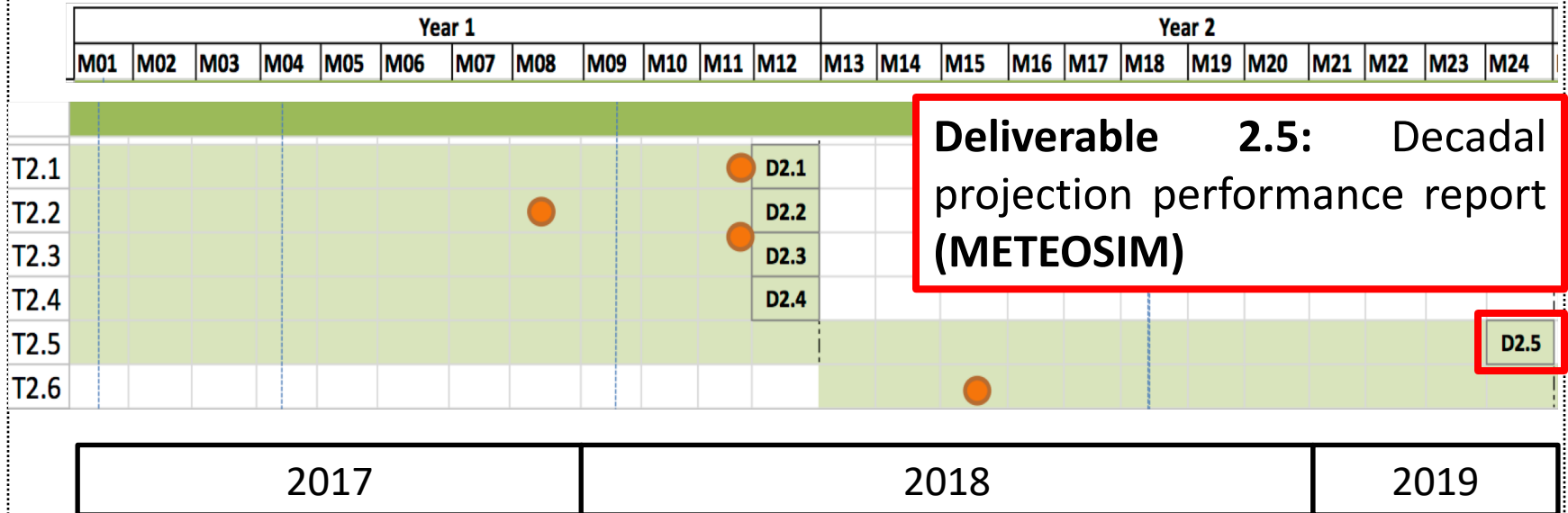




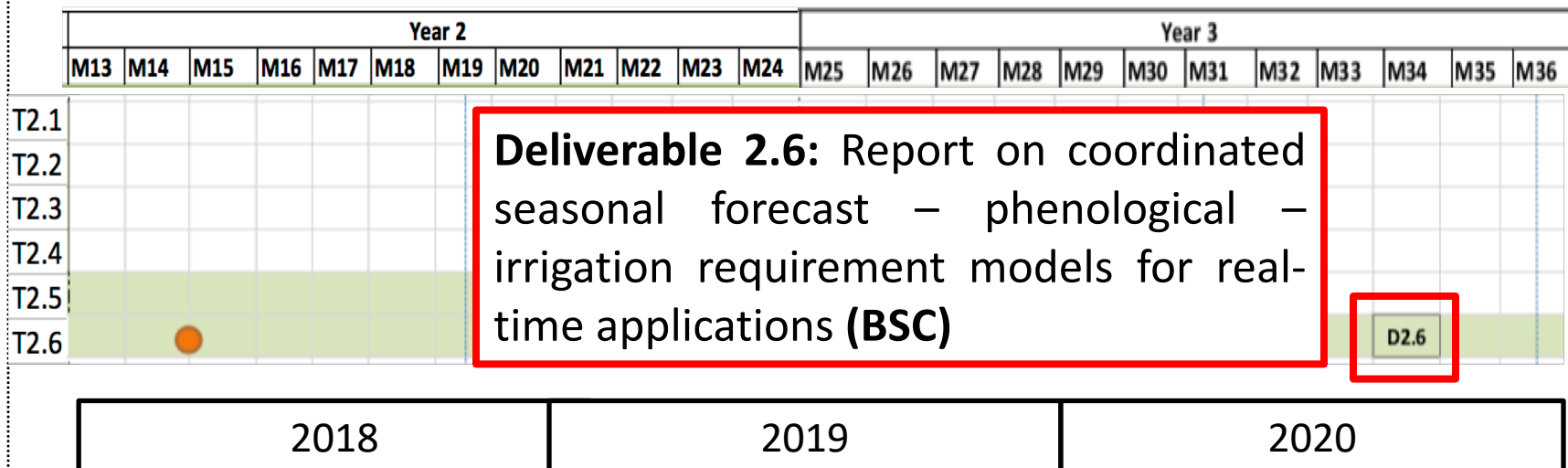
## Gantt Diagram of WP2

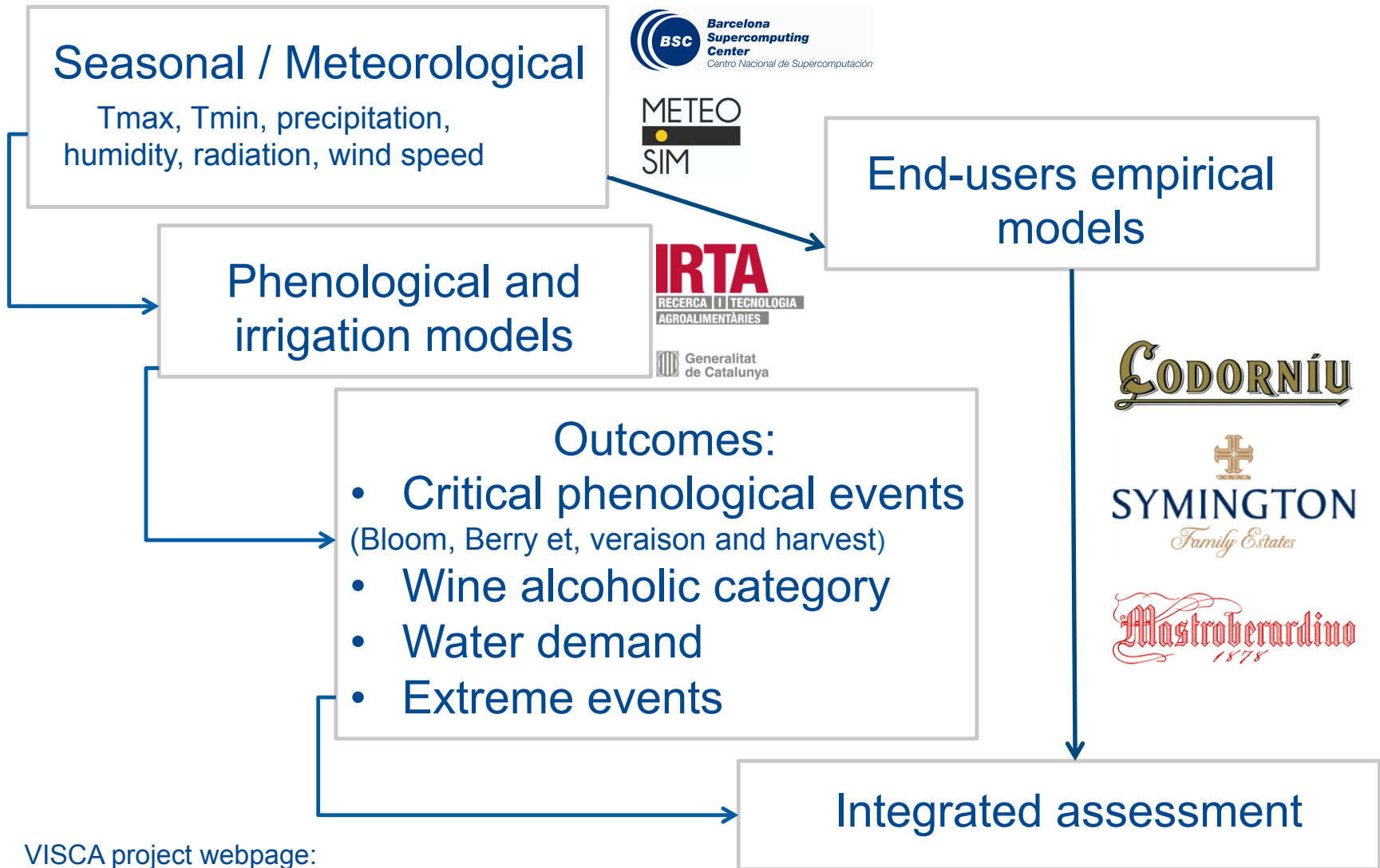


## Gantt Diagram of WP2



## Gantt Diagram of WP2. What we have to do?





VISCA project webpage:  
<http://visca.eu/>

# Status of BSC tasks

## Completed

- **Verification of raw model (ECMWF System 4 and ECMWF System 5) against reanalysis (JRA55)**
  - Performed globally (monthly / 3-monthly) for Tmax, Tmin, Tmean and precip
    - Fair Ranked Probability Skill Score
    - Fair Continuous Ranked Probability Skill Score
    - Ensemble Mean Correlation
    - Reliability diagrams
- **Verification of raw model (ECMWF System 5) against demo-site observations (Ataide, Raïmat and Mirabella)**
  - Performed globally (monthly / 3-monthly) for Tmax, Tmin, Tmean and precip
    - Fair Ranked Probability Skill Score
    - Fair Continuous Ranked Probability Skill Score
    - Ensemble Mean Correlation
    - Reliability diagrams



# Status of BSC tasks

## Completed

- **Bias correction**
  - Performed globally (monthly / 3-monthly) for ECMWF System5 and JRA55
    - Calibration
    - Simple bias correction
- **Verification of bias-corrected model (ECMWF System 5) against reanalysis (JRA55)**
  - Performed globally (monthly / 3-monthly) for Tmax, Tmin, Tmean and precip
    - Fair Ranked Probability Skill Score
    - Fair Continuous Ranked Probability Skill Score
    - Ensemble Mean Correlation
    - Reliability diagrams

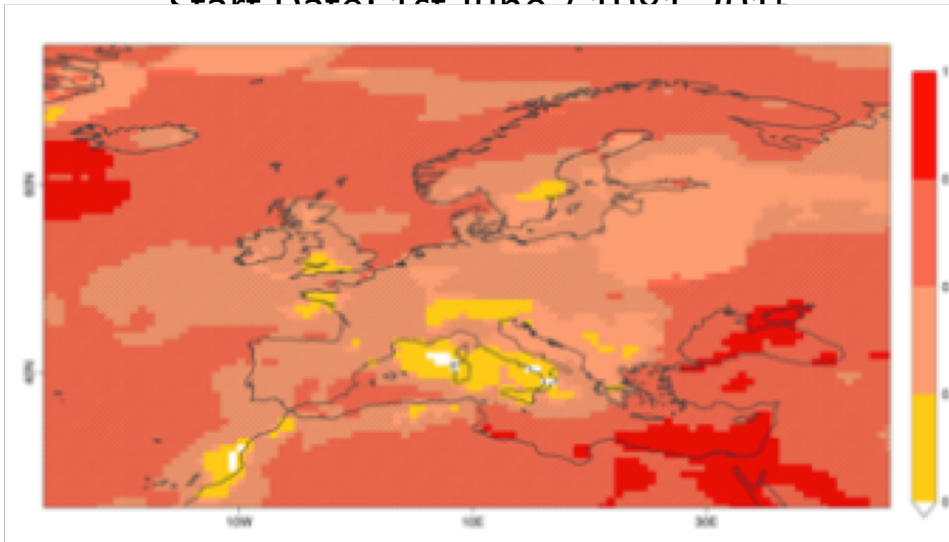
# Status of BSC tasks

## Completed

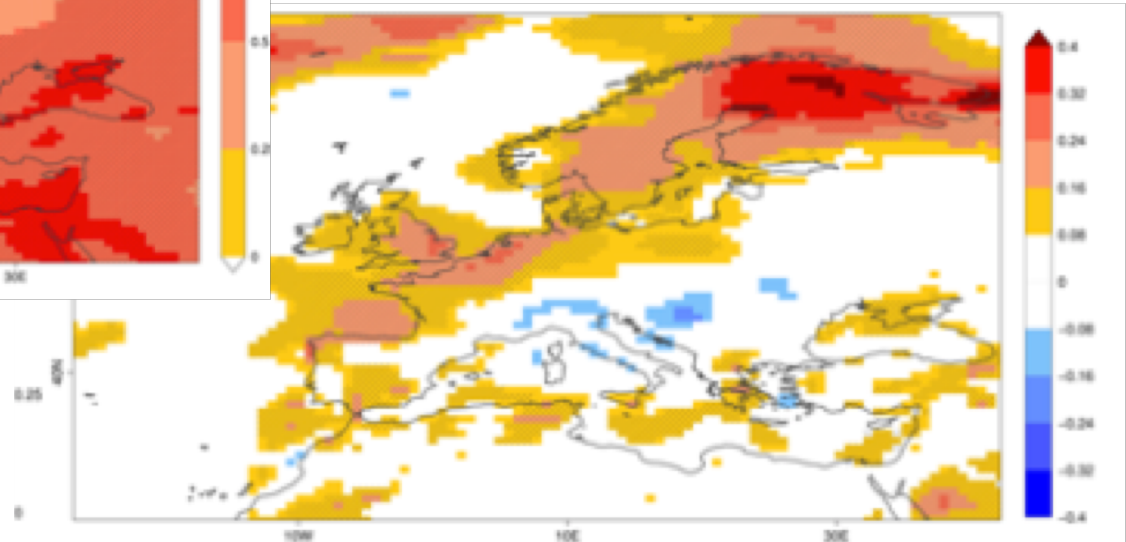
- **Operational implementation of bias-corrected System 5 forecasts**
  - Performed globally (monthly / 3-monthly) for ECMWF System5 and JRA55
    - Calibrated
    - Verified with the Fair Ranked Probability Skill Score
  - Performed at each demo-site (monthly basis for tas and prlr)
    - Downscaled (calibrated)
    - Verified with the Fair Ranked Probability Skill Score

## Results achieved

JAS / tas / System 5 Ens-mean correlation /  
Start Date: 1st June / 1981-2015

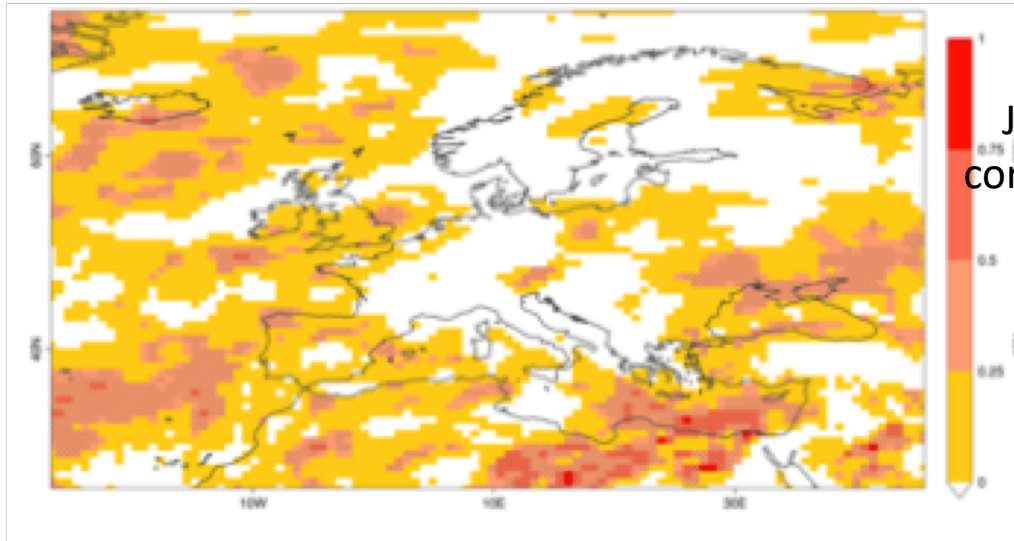


JAS / tas / System 5 – System 4 ens. Mean  
correlation / Start Date: 1st June / 1981-2015

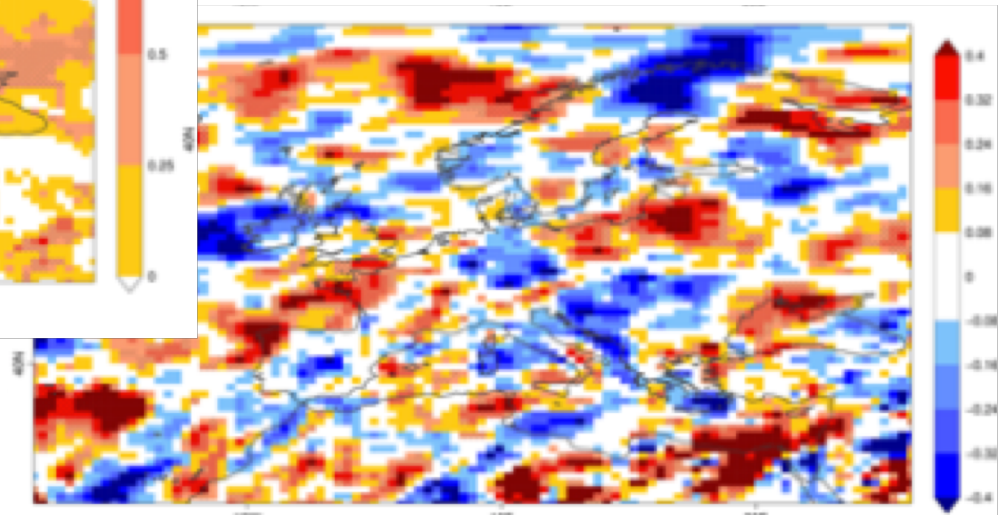


## Results achieved

JAS / tas / System 5 Ens-mean correlation /  
Start Date: 1st June / 1981-2015



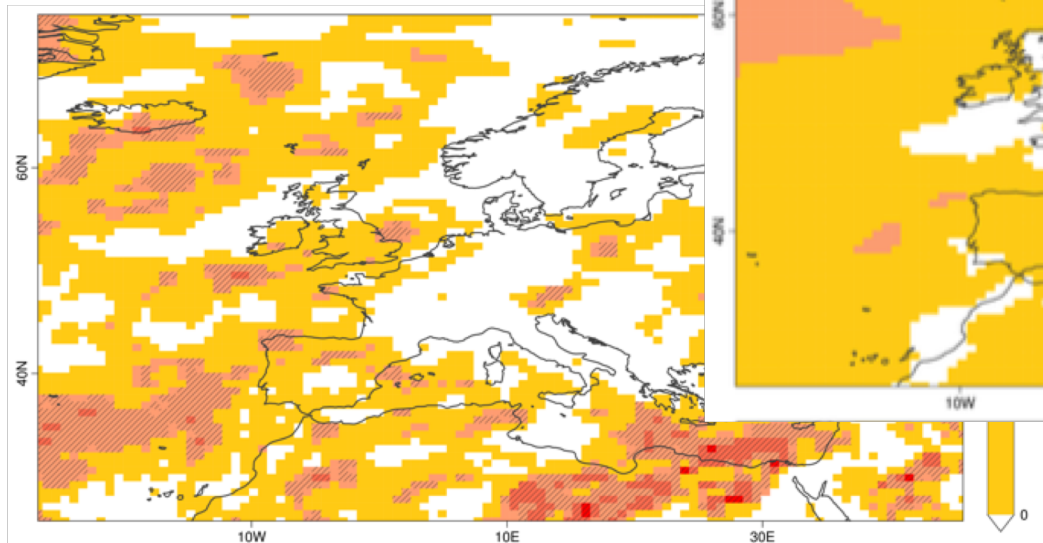
JAS / prlr / System 5 – System 4 ens. Mean correlation / Start Date: 1st June / 1981-2015



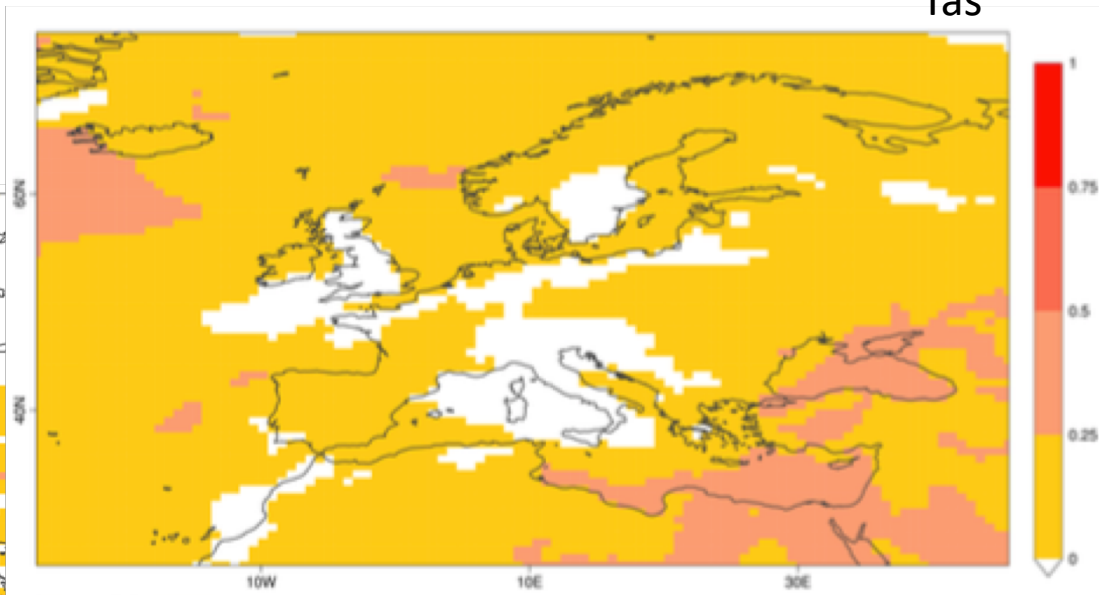
## Results achieved

JAS / ECMWF System 5/ FRPSS / Start Date: 1st June /  
1981-2015

Precipitation



Tas

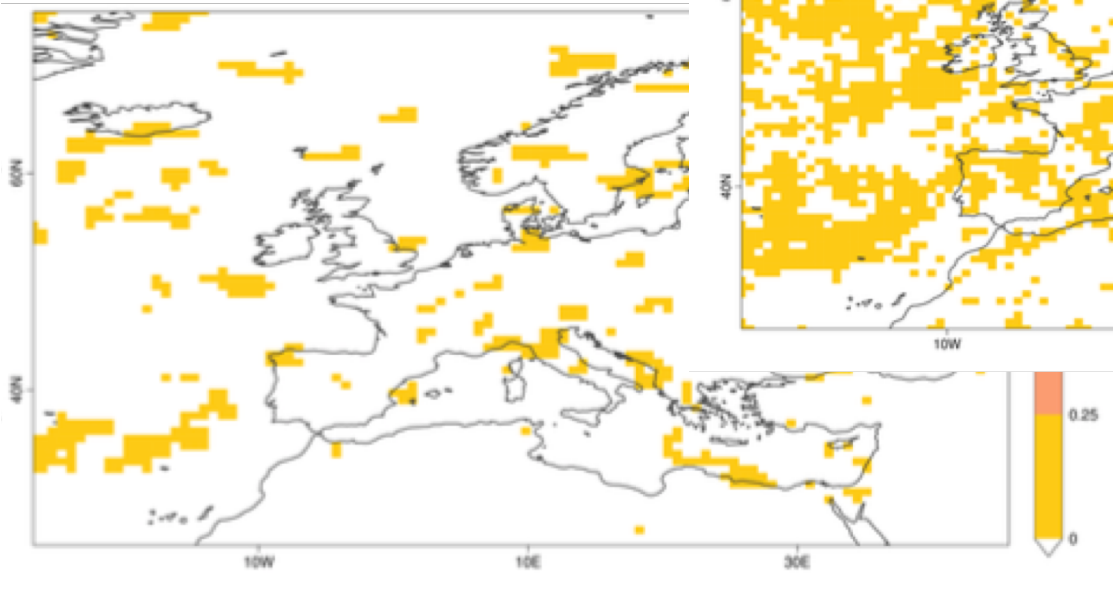




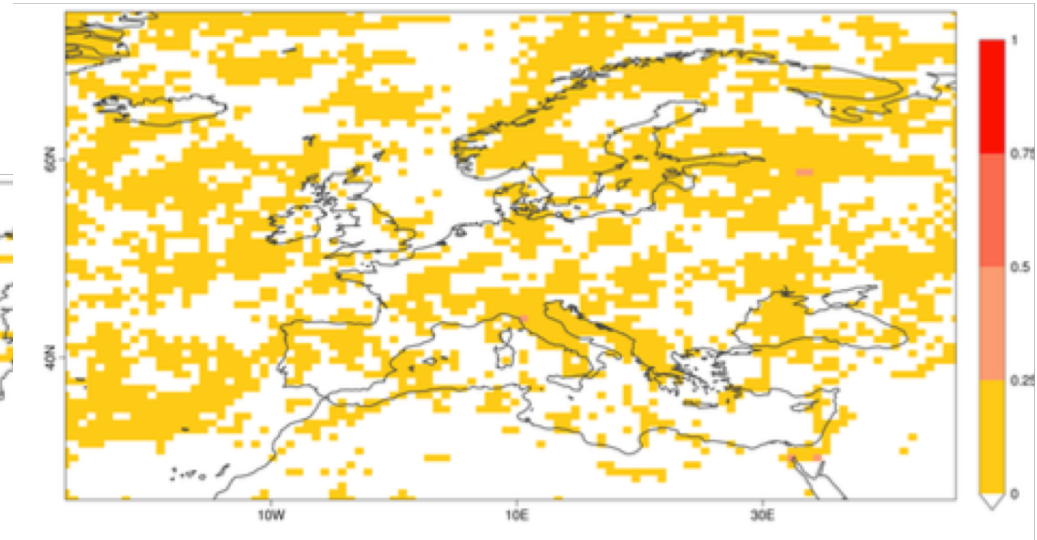
## Results achieved

JAS / Calibrated ECMWF System 5 / CFRPSS / Start Date:  
1st June / 1981-2015

Precipitation



Tas



# Results achieved

**Table 1.** Ensemble mean correlation, FRPSS and FCRPSS for raw and calibrated predictions for JAS (start date on 1<sup>st</sup> of June against each of the three demo-sites: Raïmat (Codorniu), Quinta do Ataíde (Symington) and Mirabella-Eclano (Mastroberardino)).

	Ens. Mean Correlation				FRPSS								
	Raw		Downscaled		Raw		Downscaled						
	T <sub>m</sub>	Prc	T <sub>m</sub>	Prc	T <sub>m</sub>	Prc	T <sub>m</sub>	Prc					
<u>Raïmat</u>	0.20	0.20	0.17	0.05	-0.09	0.04	-0.02	-0.01					
<u>Quinta do Ataíde</u>	0.45	0.21	0.43	-0.03	0.10	0.06	0.10	-0.01					
<u>Mirabella-Eclano</u>	-0.37	-0.12	-0.32	0.12	-0.42	-0.07	-0.05	-0.08					
									CFRPSS				
									Raw	Downscaled			
									T <sub>m</sub>	Prc	T <sub>m</sub>	Prc	
									<u>Raïmat</u>	-0.14	-0.46	-0.05	-0.46
									<u>Quinta do Ataíde</u>	0.08	-0.61	0.02	-0.60
									<u>Mirabella-Eclano</u>	-0.56	-0.53	-0.48	-0.52

## Next steps

- **End of perfect-prognosis analog downscaling application. Verification.**
- **Verification and bias correction of MeteoFrance System 5 and GLOSEA 5 (MetOffice)**
- **Multi-model construction and verification.**



Thank you for you Attention!

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**[www.visca.eu](http://www.visca.eu)**



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# **TASK 2.2**

## **Operational weather forecast extreme events system**

**2nd General Meeting**  
Napoli, 2018 Dec 10<sup>th</sup> – 12<sup>th</sup>

**Ignasi Porras**  
[iporras@meteosim.com](mailto:iporras@meteosim.com)

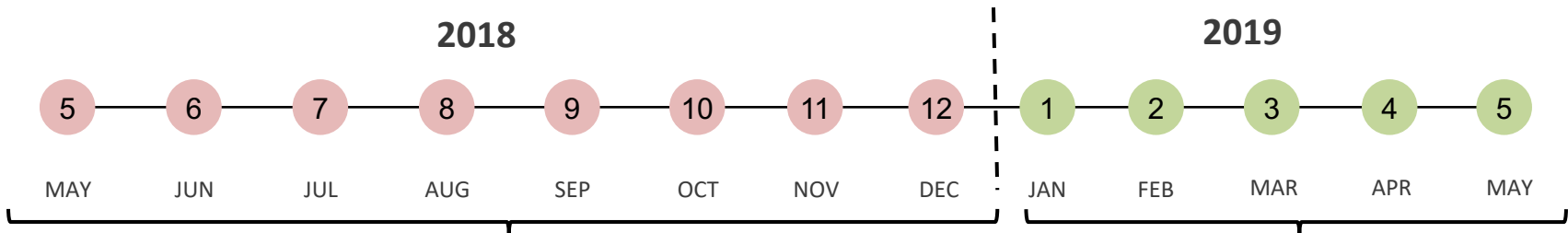




## T2.2 – Summary of the task

- **Main objectives of the task:**
  - Develop and supply weather forecast services:
    - Short-term forecast: up to 48 h.
    - Medium-term forecast: up to 240 h.
- **Delivery date:**
  - Month #12 (Jun 2018)
- **Main use:**
  - Minimize risks related to coming weather extreme events.
  - Planning short-term and mid-term vineyards activities.
- **Task status:**
  - Short-term operational system [COMPLETED]
  - Mid-term operational system [COMPLETED]
  - Operational Raimat weather station data. [COMPLETED]
  - D2.2. Report on weather forecast extreme events (M12). [COMPLETED]
  - Short-term model bias reduction improvement. [ONGOING]
  - Update D2.2. (M24). [NOT STARTED]

## T2.2 – Results achieved



- **Short Term Forecast:**

- Configuration domains schema for the 3 demo-areas.
- JSON short-term data.
- Operational system.

- **Mid-Term Forecast:**

- GEFS data operational download.
- Post-process -> Fractions of models that falls in each bin.
- JSON mid-term data.
- Operational system.

- **Raimat weather station:**

- Send data operationally to Meteosim's FTP.

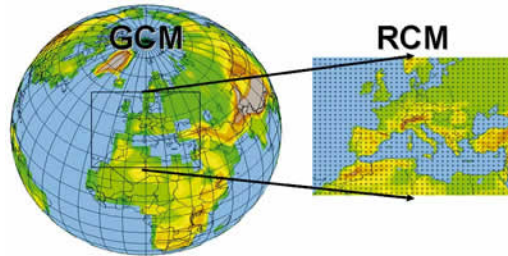
- **Short-term model bias reduction :**

- Best WRF model configuration.
- WRF Data Assimilation System (data from satellites, METAR, RAOB and weather stations)
- Background Error Covariance.

- **Update D2.2.**

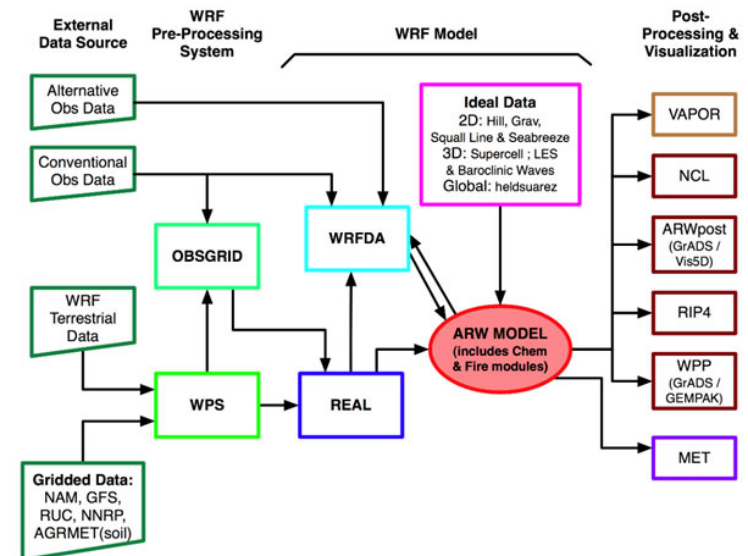
## T2.2 – Short-term obtaining dataset

- **Model data:**
  - Weather Research & Forecasting (WRF-ARW).
  - 1km horizontal resolution.
  - 48h forecasting length.
  - 2 updates per day: 00 and 12 UTC.
  - Deterministic forecasting.

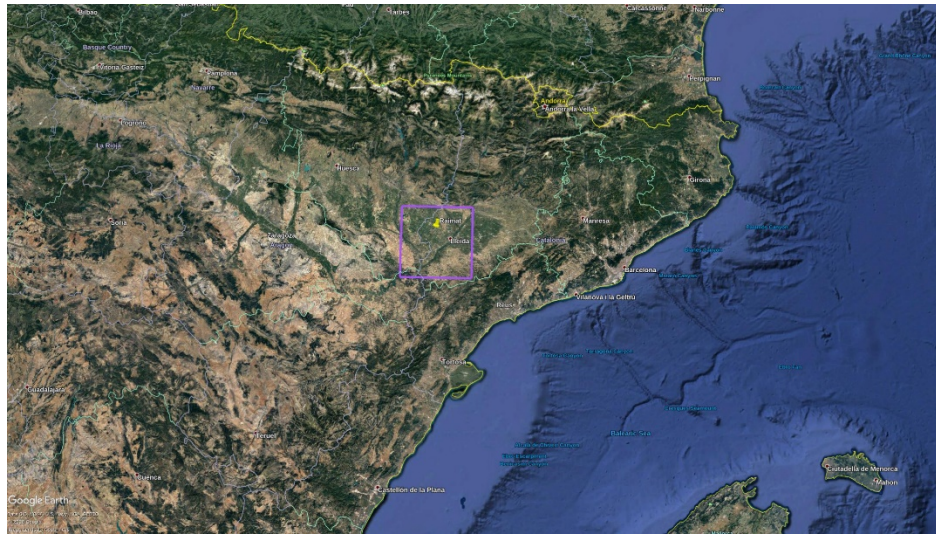


- **Variables:**
  - Temperature.
  - Precipitation.
  - Relative humidity.
  - Wind speed.
  - Global radiation.

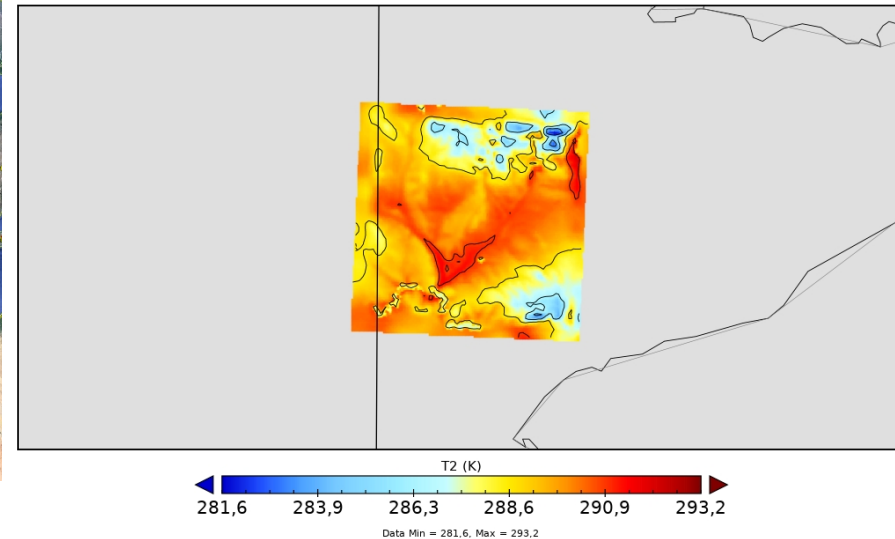
*WRF Modeling System Flow Chart*



## T2.2 – Results short-term – Raimat fcst



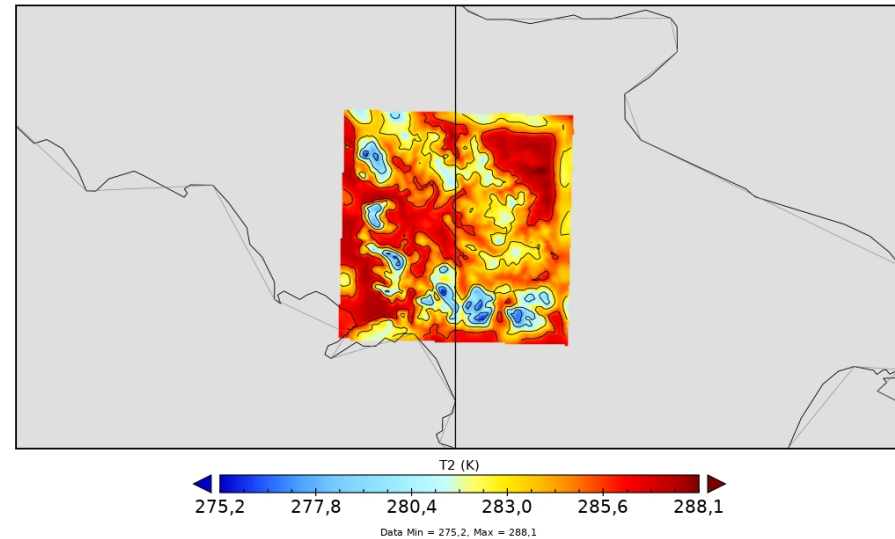
2 m Temperature - Raimat demo-area



## T2.2 – Results short-term – Mastroberardino fcst



2 m Temperature - Mastroberardino demo-area

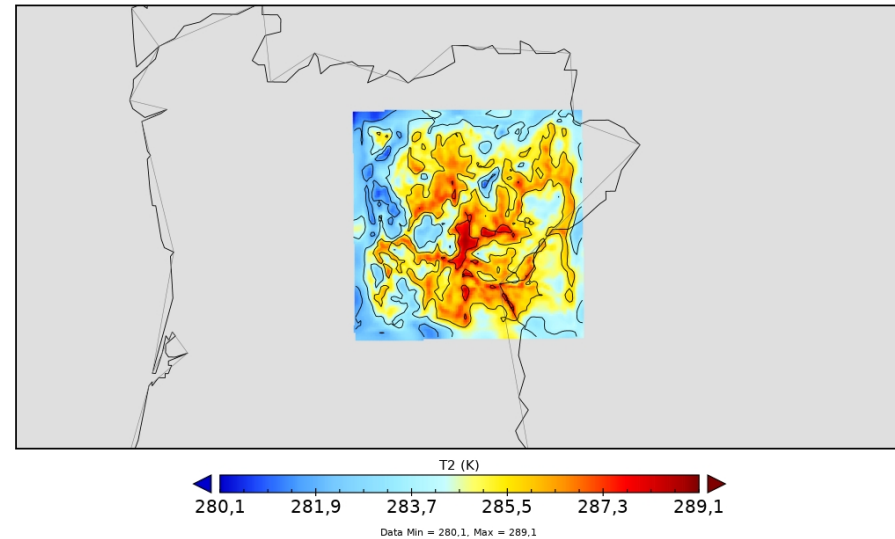




## T2.2 – Results short-term – Symington fcst



2 m Temperature - Symington demo-area



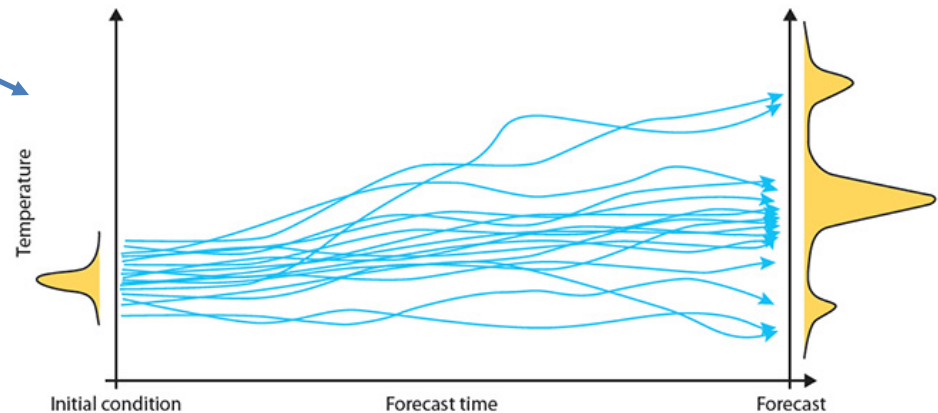
## T2.2 – Mid-term obtaining dataset

- **Model data:**

- Global Ensemble Forecasting System (GEFS).
- 0,5 deg horizontal resolution.
- 240h forecasting length.
- 2 updates per day: 00 and 12 UTC.
- Probabilistic forecasting.

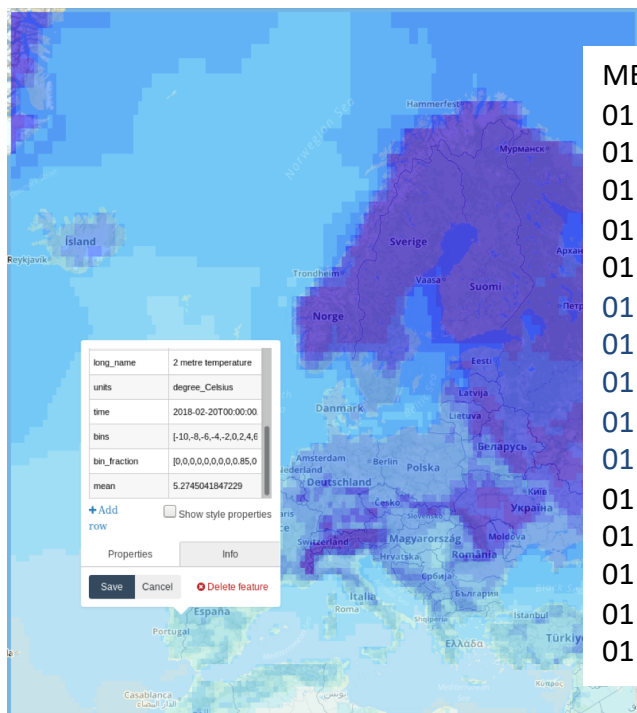
- **Variables:**

- Temperature.
- Maximum temperature.
- Minimum temperature.
- Precipitation.
- Relative humidity.
- Wind speed.
- Global radiation.



## T2.2 – Results mid-term

## Europe level



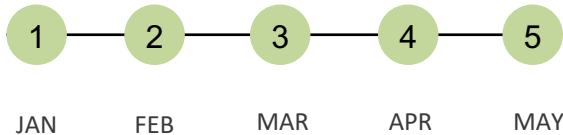
## Demo-site time series level

MEMBER		valid_date	T2M	RH2M	WSPD10M	PREC	DSWRF	LON	LAT	COMPANY
01	2018120600	10.0	78	2.8	0.0	0	0.50742	41.6625	Codorniu	
01	2018120603	9.1	70	3.2	0.0	0	0.50742	41.6625	Codorniu	
01	2018120606	8.4	73	3.0	0.0	0	0.50742	41.6625	Codorniu	
01	2018120609	10.9	68	3.0	0.0	60	0.50742	41.6625	Codorniu	
01	2018120612	15.4	60	5.8	0.0	210	0.50742	41.6625	Codorniu	
01	2018120600	6.2	81	0.8	0.0	0	14.9814	41.0615	Mastroberardino	
01	2018120603	6.3	77	0.3	0.0	0	14.9814	41.0615	Mastroberardino	
01	2018120606	7.0	79	1.2	0.0	0	14.9814	41.0615	Mastroberardino	
01	2018120609	11.4	70	2.8	0.0	140	14.9814	41.0615	Mastroberardino	
01	2018120612	13.7	57	3.6	0.0	280	14.9814	41.0615	Mastroberardino	
01	2018120600	6.7	94	0.5	0.0	0	-7.1091	41.2484	Symington	
01	2018120603	6.5	95	0.9	0.0	0	-7.1091	41.2484	Symington	
01	2018120606	5.9	96	1.0	0.0	0	-7.1091	41.2484	Symington	
01	2018120609	8.8	97	0.8	0.0	30	-7.1091	41.2484	Symington	
01	2018120612	14.5	71	1.5	0.0	180	-7.1091	41.2484	Symington	



## T2.2 – Next steps

2019

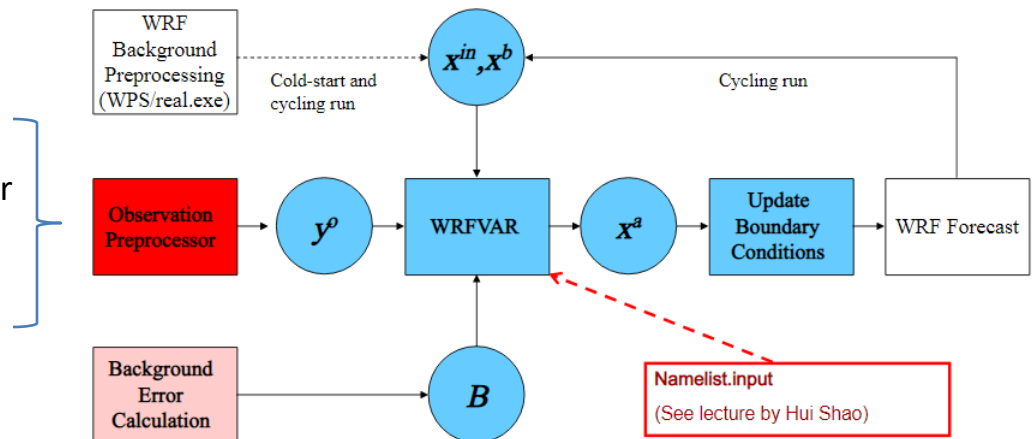


- **Short-term model bias reduction :**

- Best WRF model configuration.
- WRF Data Assimilation System (data from satellites, METAR, RAOB and weather stations)
- Background Error Covariance.

- **Update D2.2.**

### WRF-Var in the WRF Modeling System





Thank you for you Attention!

**Ignasi Porras**  
**iporras@meteosim.com**

**[www.visca.eu](http://www.visca.eu)**



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## WP2 Task 2.3 & 2.4

### Technical Meeting

10<sup>th</sup> - 12<sup>th</sup> November 2018, Naples

**Omar García Tejera**

Researcher

[omar.garcia@irta.cat](mailto:omar.garcia@irta.cat)



## Task's objectives

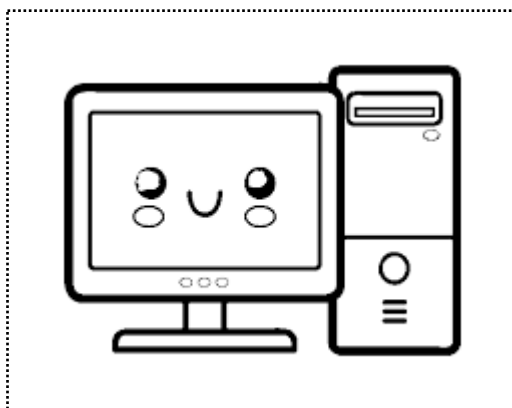
- **Task 2.3**
  - Development and implementation of:
    - A model to predict bud break
    - A model to predict the different phenological stages (from bloom to veraison)
    - A model to predict harvest
    - A model to predict the leaf fall
- **Task 2.4**
  - Development and implementation of:
    - A model to estimate future irrigation needs

## Task's objectives

- **Task 2.3**
  - Development and implementation of
    - A model to predict bud break
    - A model to predict the different phenological stages (from bloom to veraison)
    - A model to predict Harvest
    - A model to predict the leaf fall
- **Task 2.4**
  - Development and implementation of
    - A model to estimate future irrigation needs

## Task's objectives

Weather Forecasts  
(BSC & MeteoSim)



Run  
IRTA & UNAP  
models

Provide  
recommendations  
to the end users




# Presentation Index

- a) What have we done
- b) Where are we
- c) Future work



# What have we done

- **First approach.**

- Bud Break            BRIN (García de Cortazar-Atauri et al, 2009)
- Phenology            Berry model (Parker et al, 2011)
- Irrigation            VSIM (Williams & Ayars, 2005)



# What have we done

Seasonal weather  
forecasts



Temperature  
Monthly Basis

Bud break  
and  
Phenology model



Temperature  
Daily Basis



# What have we done

Seasonal weather  
forecasts



Temperature  
Monthly Basis



Data accommodation



Bud break  
and  
Phenology model



Temperature  
Daily Basis

## What have we done

- **VSIM (Irrigation needs)**
  - Specific to California varieties and conditions
  - Unit issues

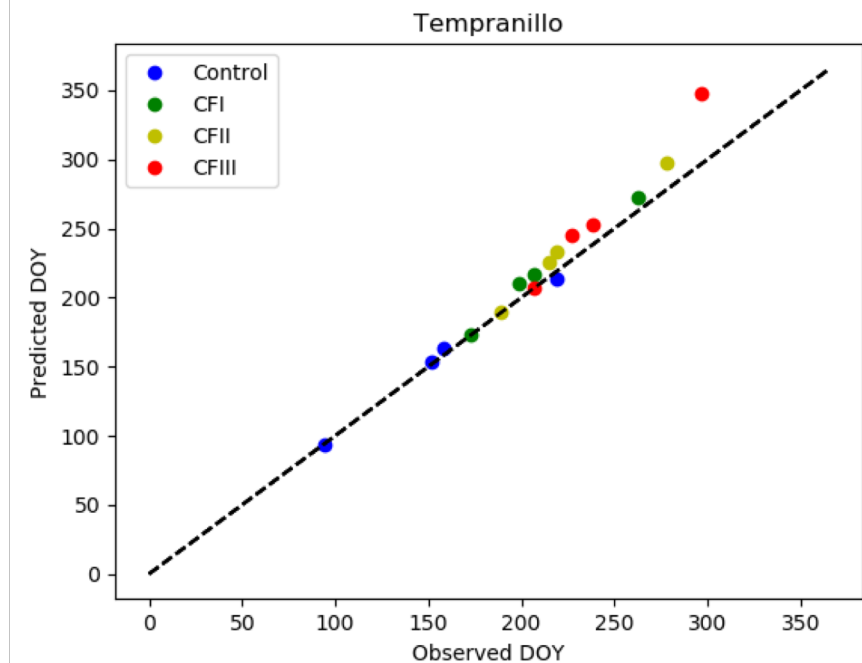
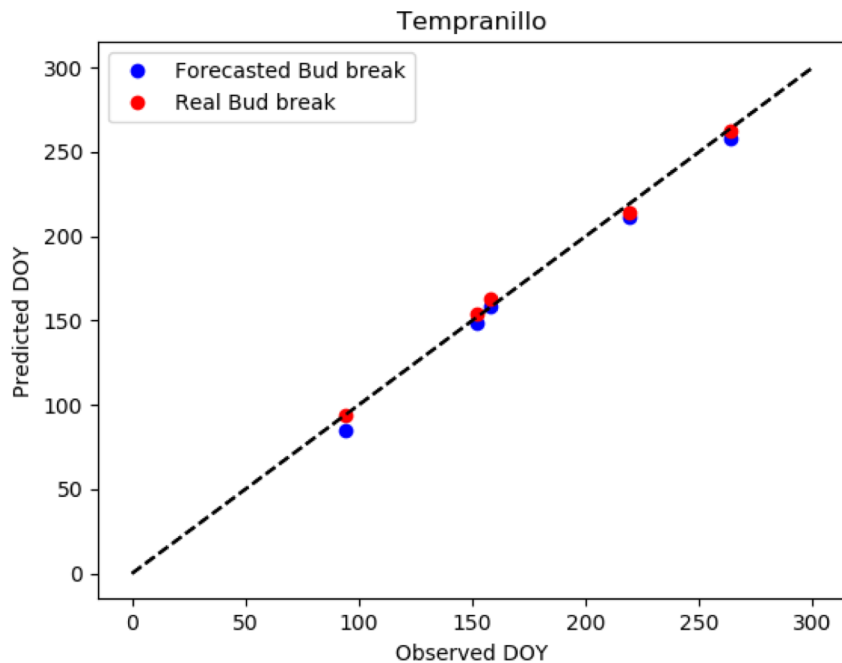
# What have we done

## IRRIGATION NEEDS

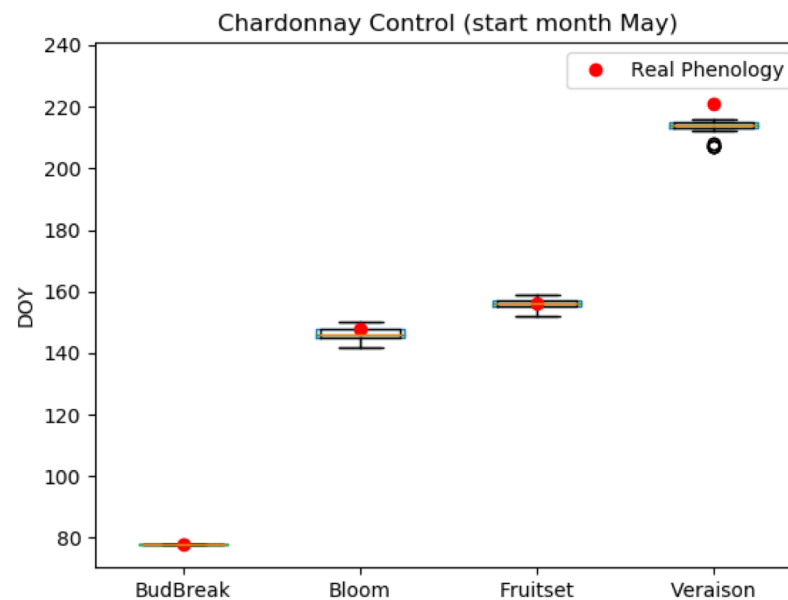
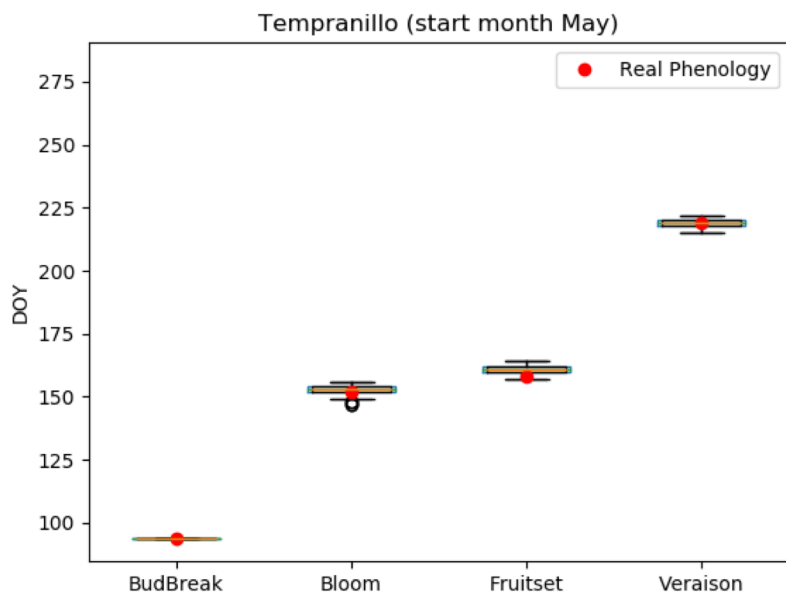


Development of a custom irrigation model for VISCA

## Where are we

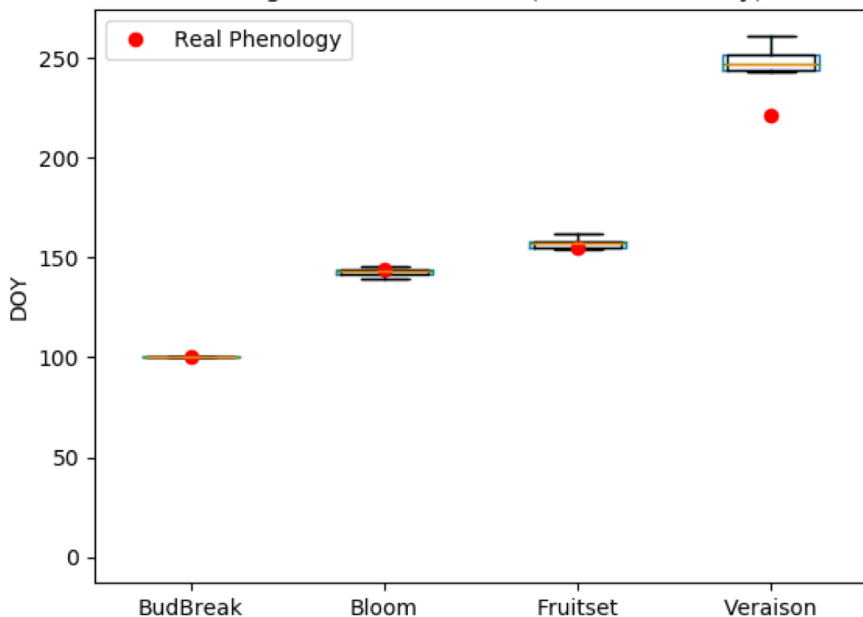


## Where are we

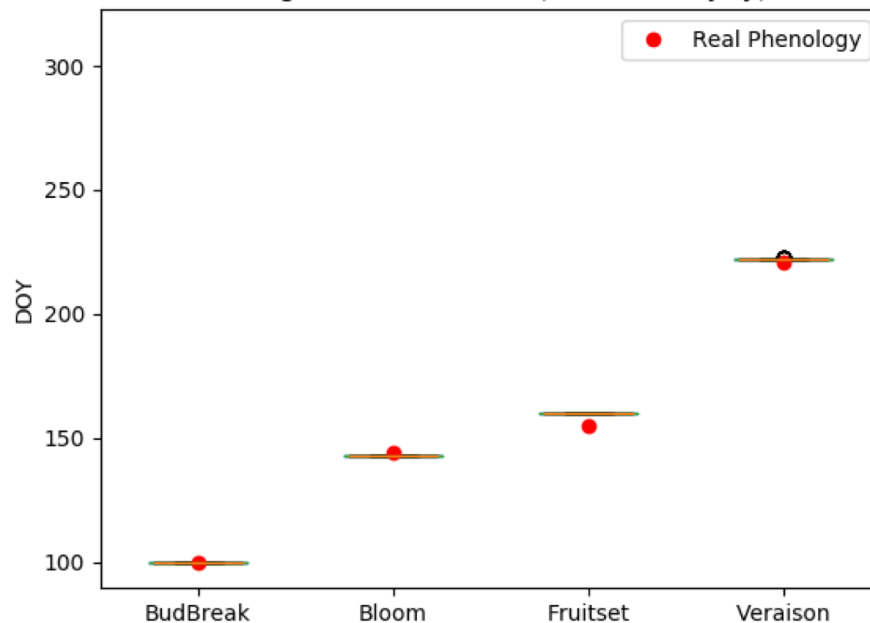


## Where are we

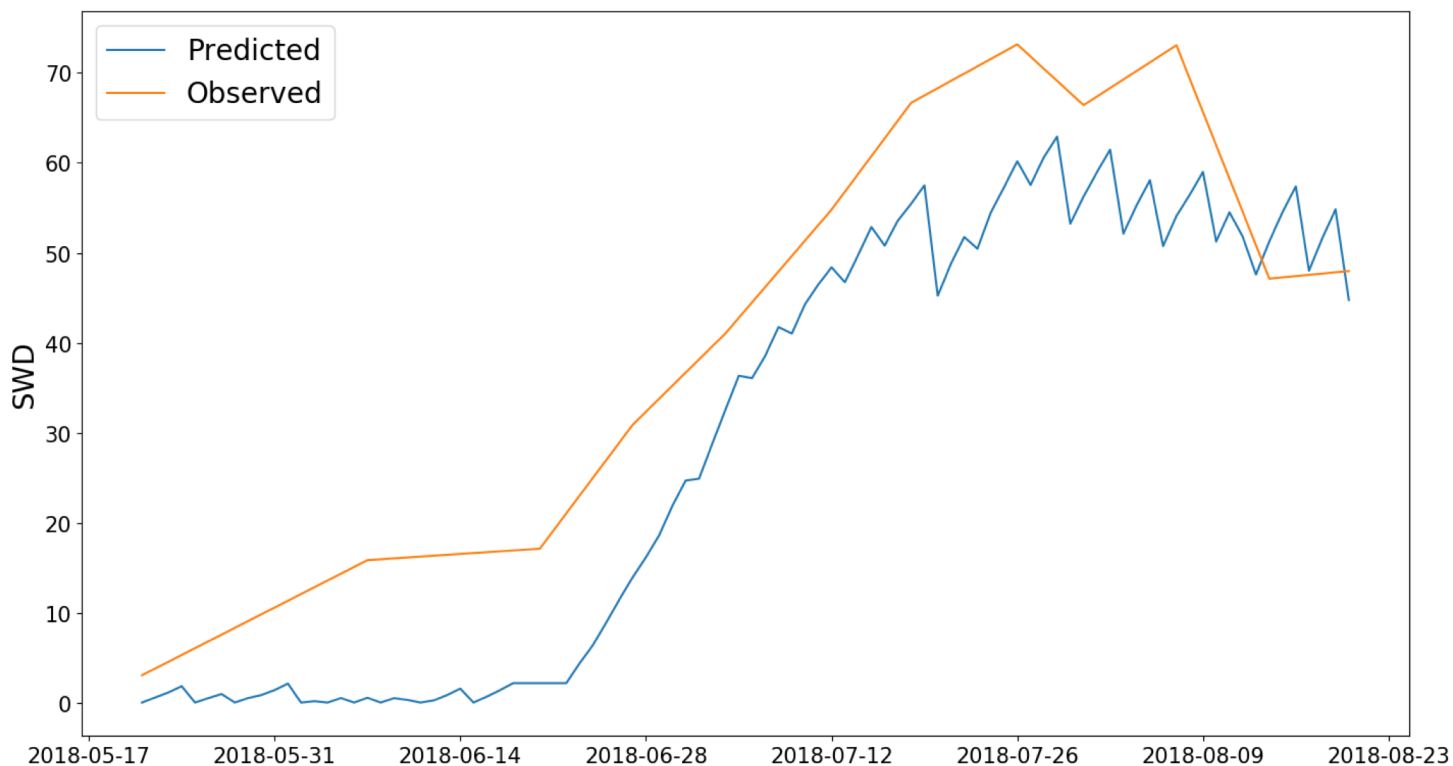
Touriga Nacional Control (start month May)



Touriga Nacional Control (start month July)

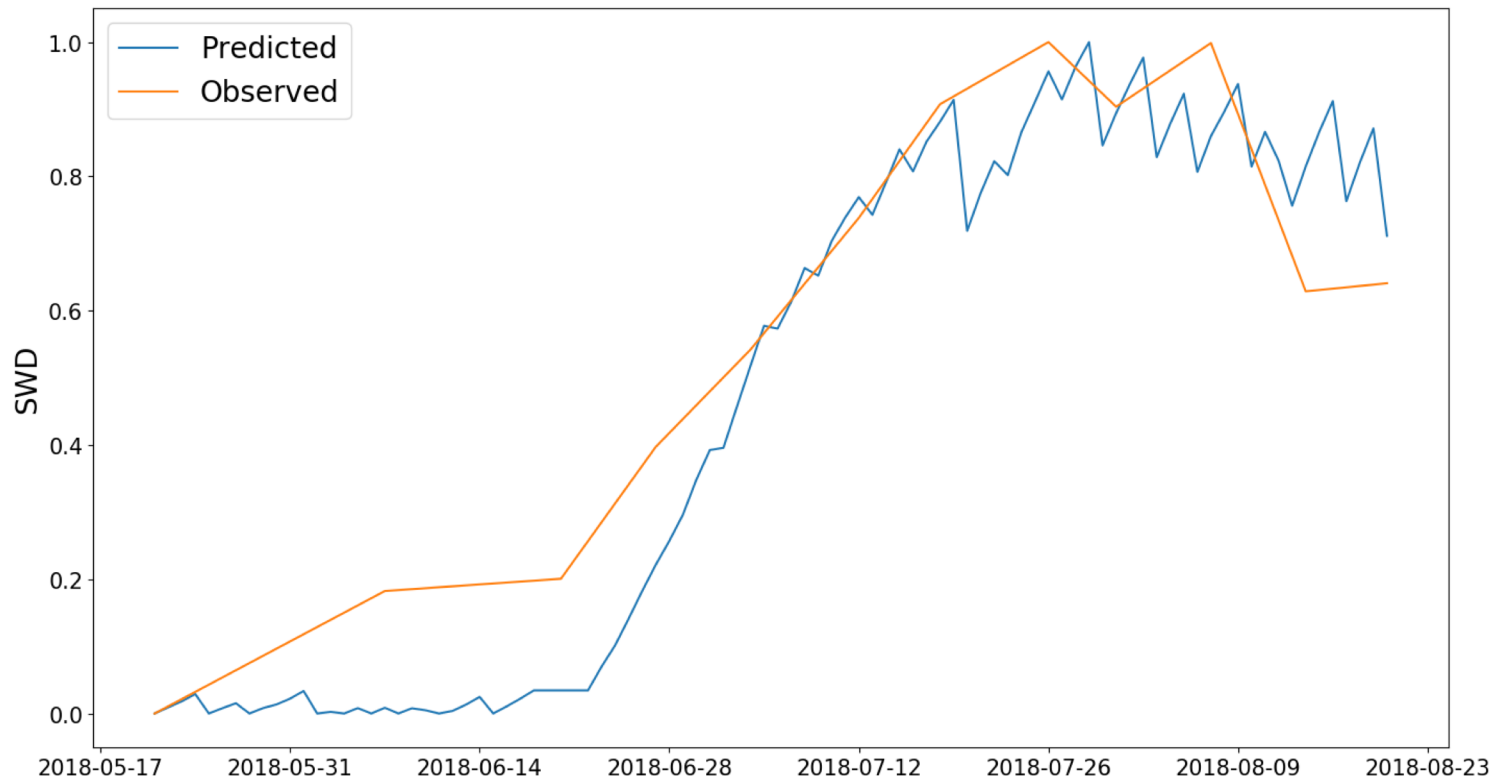


# Where are we



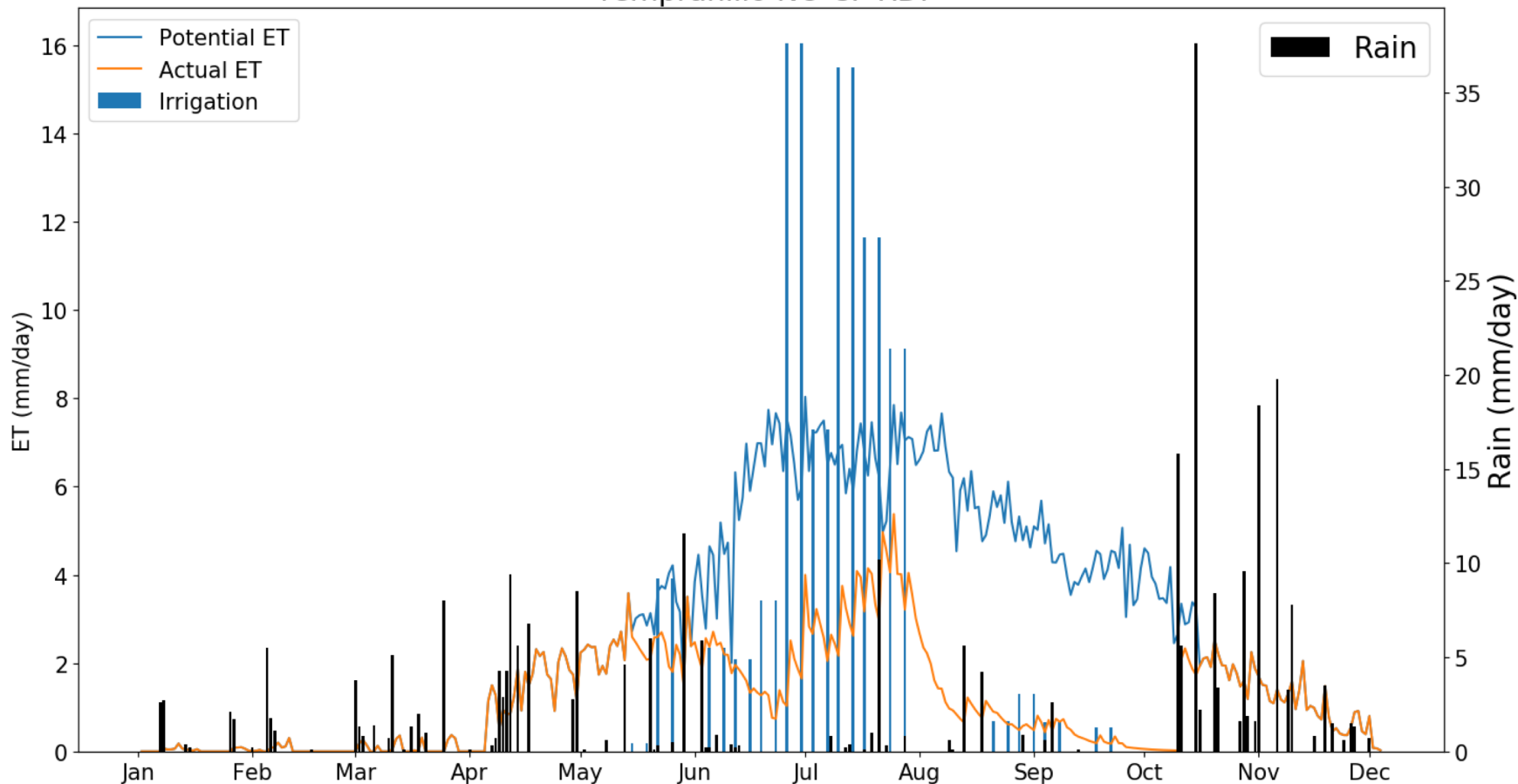


# Where are we

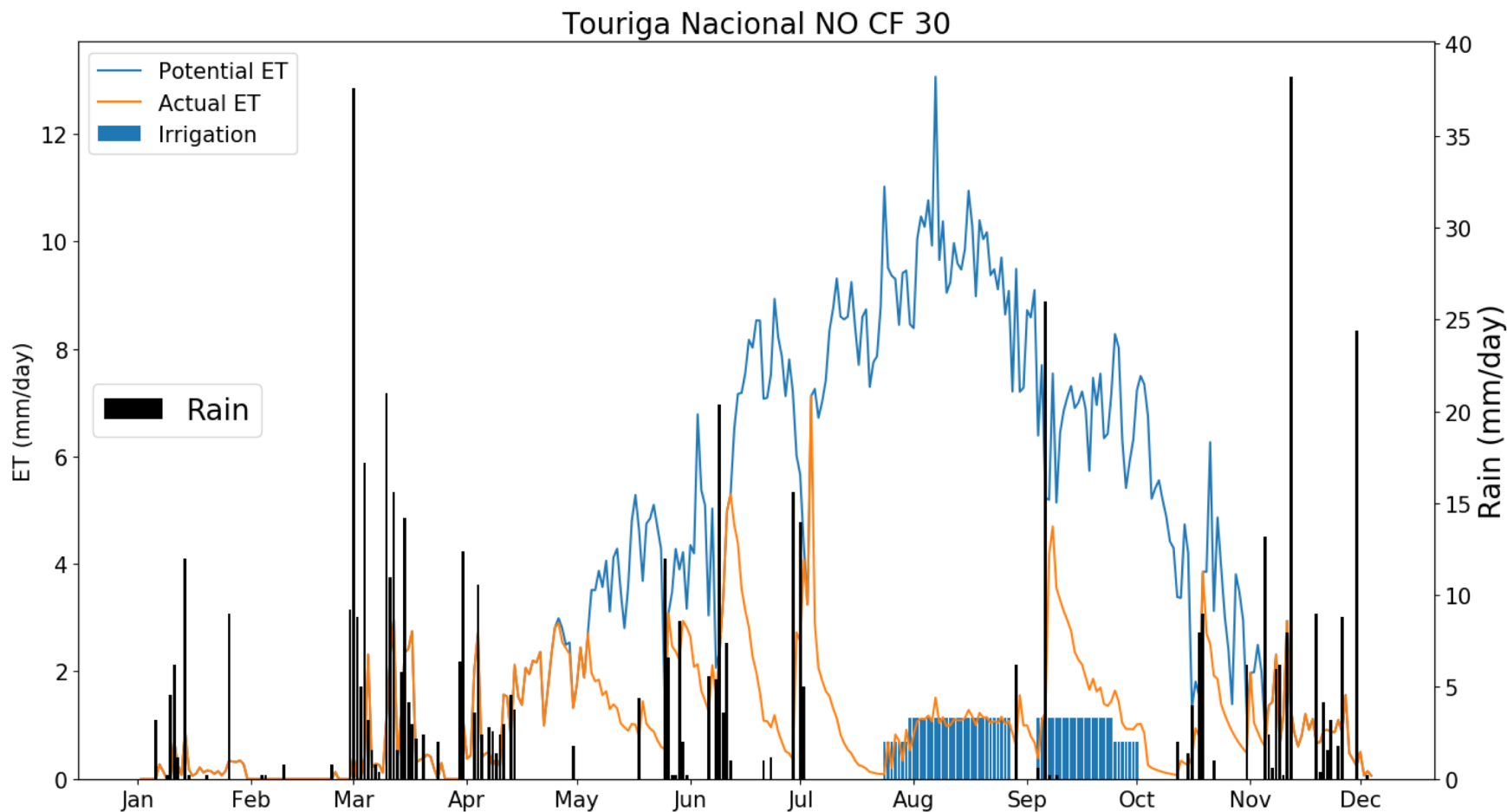


## Where are we

Tempranillo NO CF RDI



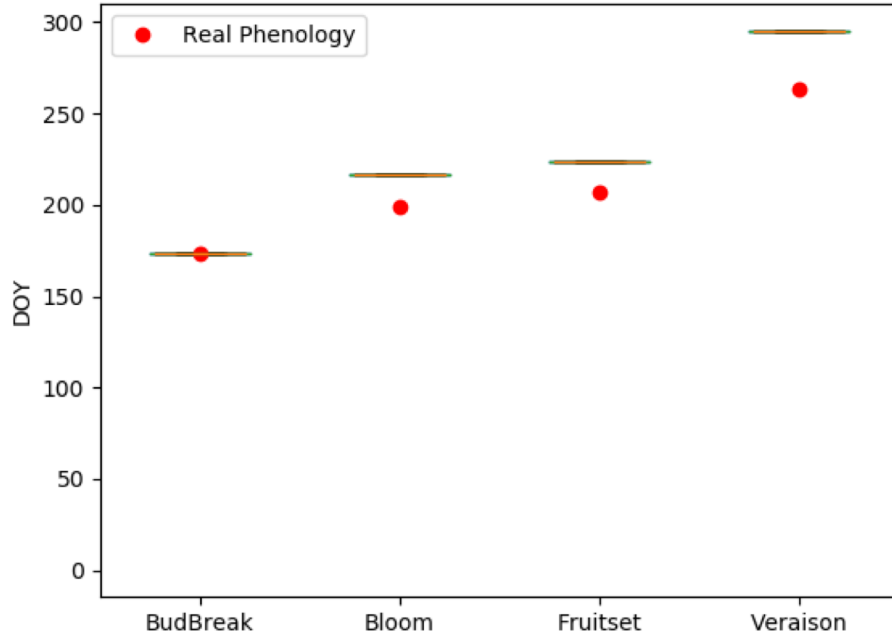
## Where are we



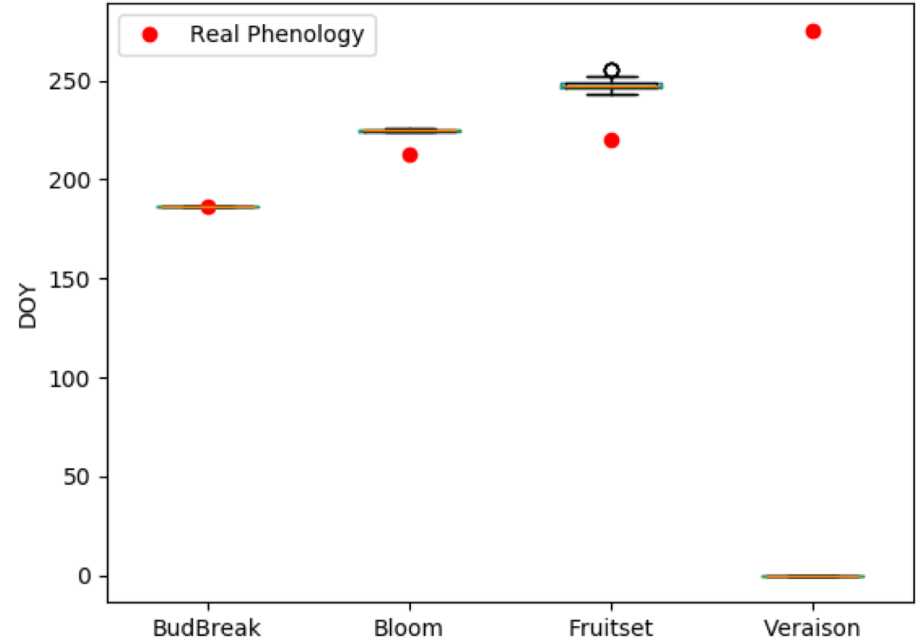
# Future Work

## Improving Model Response to Crop Forcing

Tempranillo CFI (start month May)



Touriga Nacional CFI (start month May)



## Future Work

**To compare crop coefficients values for Touriga Nacional and Aglianico to tune irrigation needs**



Thank you for you Attention!

**Omar García**  
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**[www.visca.eu](http://www.visca.eu)**



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## WP2 Task 2.3

### General Meeting

10<sup>th</sup> - 12<sup>th</sup> December 2018, Naples

**Fabrizio Carteni**  
Post-doc Researcher  
[fabrizio.carteni@unina.it](mailto:fabrizio.carteni@unina.it)





# Task's objectives

- **Task 2.3**
  - Development and implementation of:
    - A model to predict bud break
    - A model to predict the different phenological stages (from bloom to veraison)
    - A model to predict harvest
    - A model to predict the leaf fall

# Presentation Index

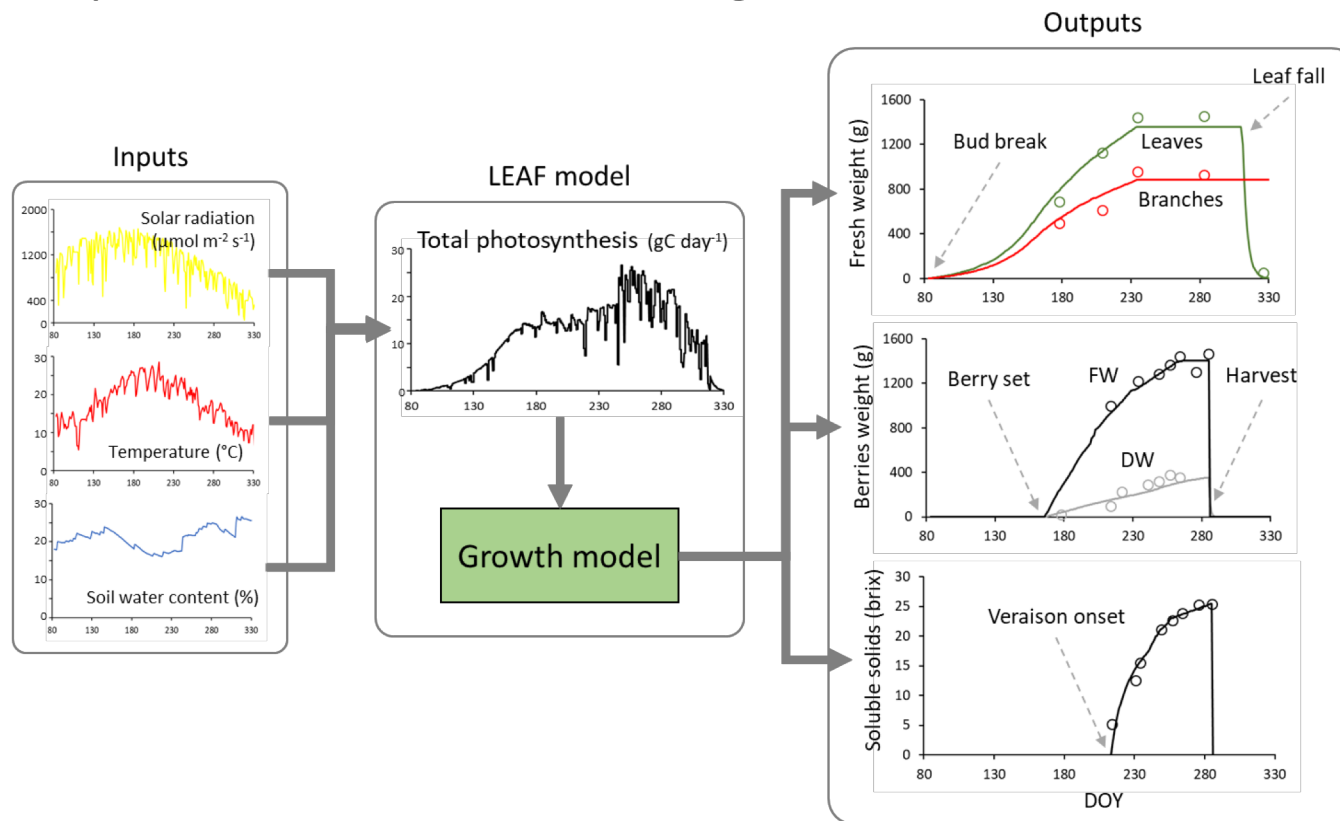
**a) What have we done?**

**b) Where are we?**

**c) Future work**

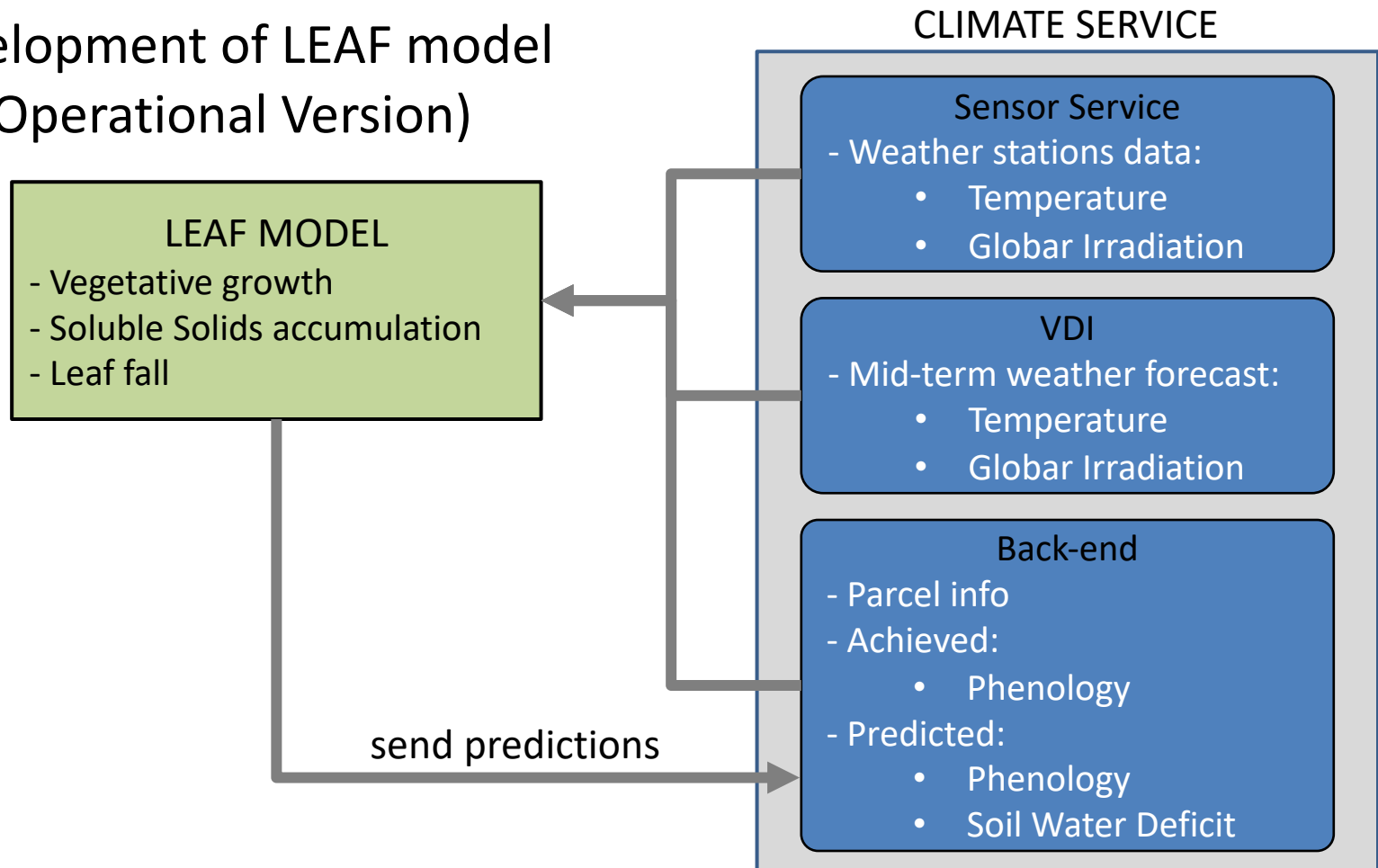
# What have we done?

- Development of LEAF model engine



# What have we done?

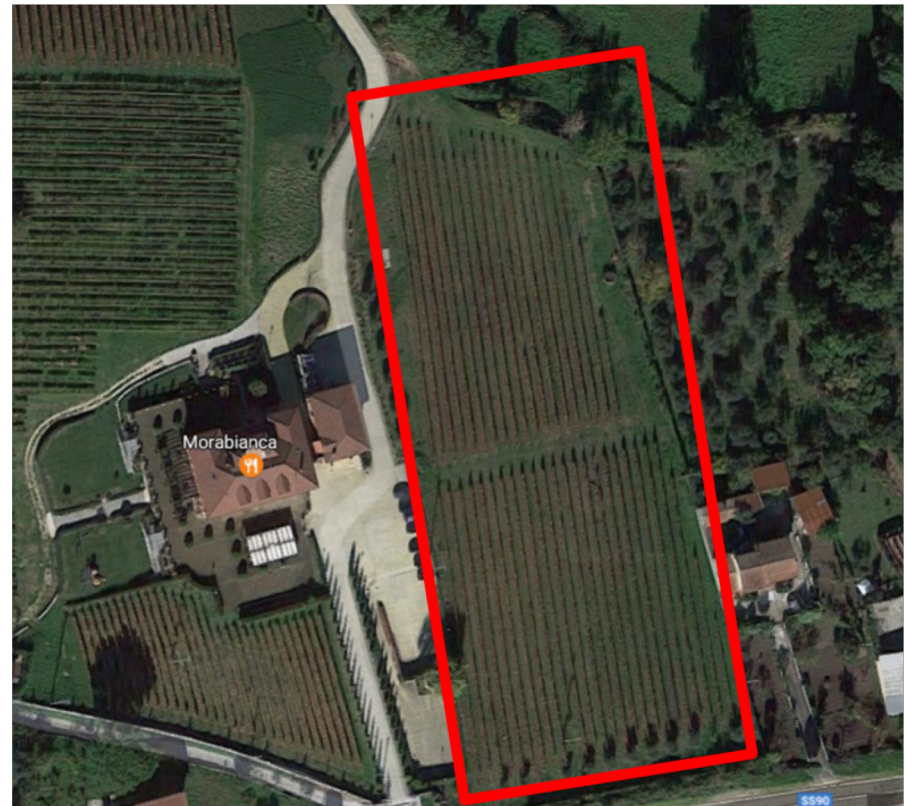
- Development of LEAF model (Operational Version)



# Where are we?

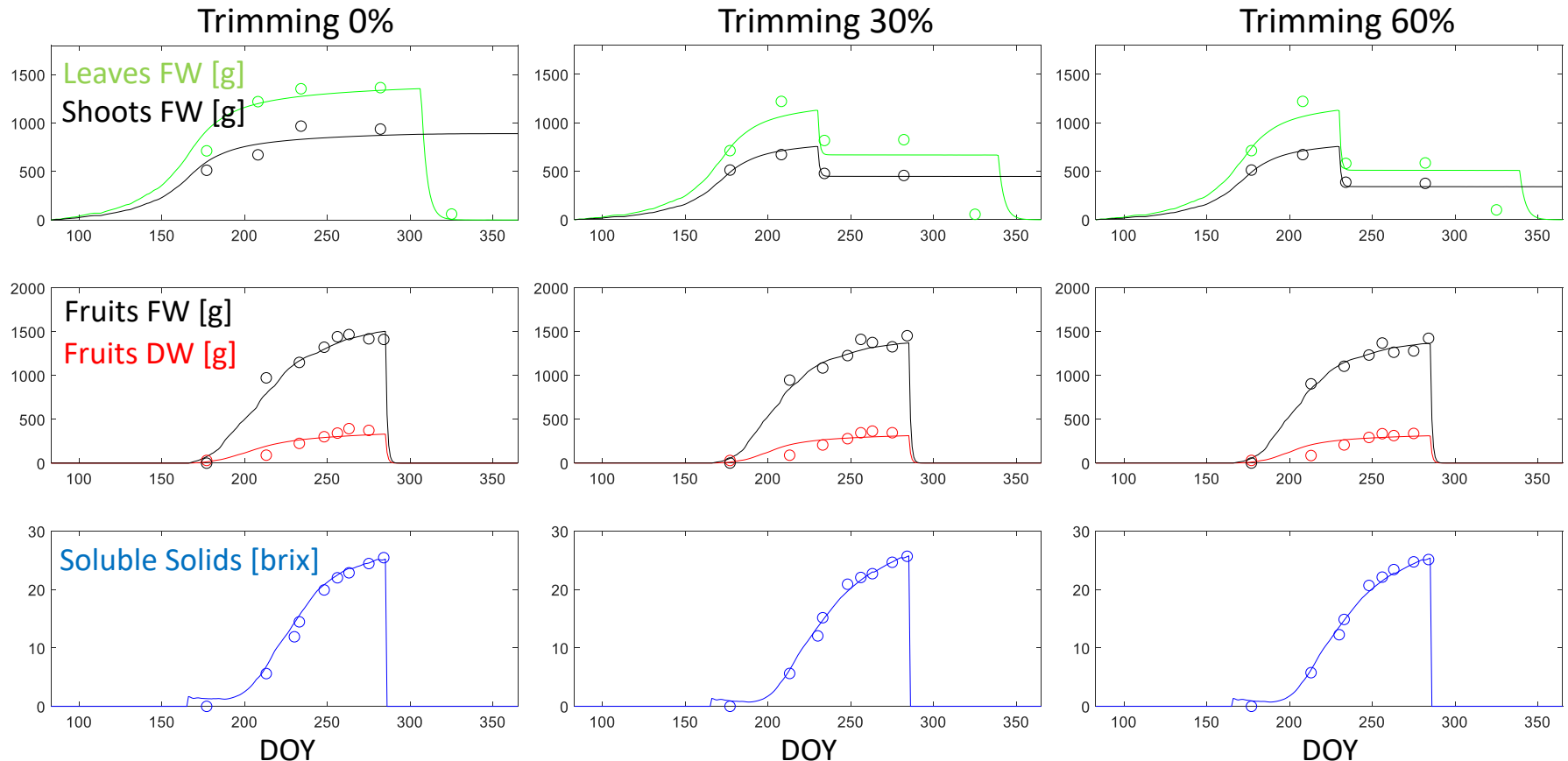
- LEAF model calibration
  1. Mastroberardino
    - Aglianico

TENUTA RADICI



# Where are we?

- LEAF model calibration (2017 - Aglianico - No irrigation)



# Where are we?

- LEAF model calibration

- Mastroberardino (2017)

- Aglianico



- Codorniu (2018)

- Tempranillo



- Chardonnay



● Crop Forcing

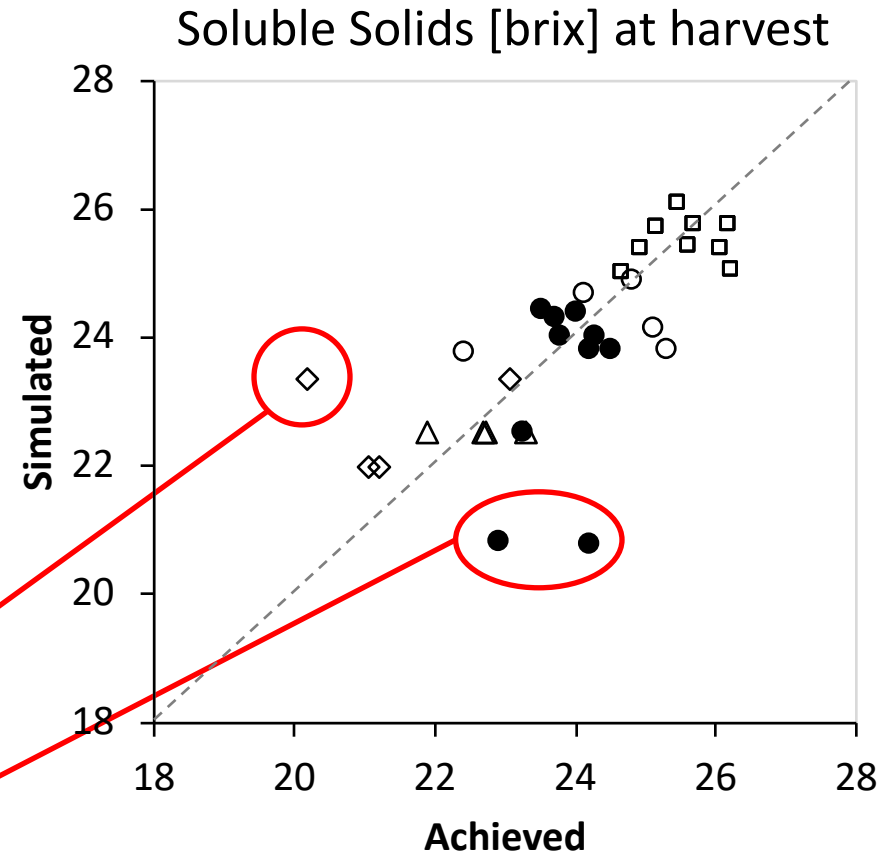
- Symington (2018)

- Touriga Nacional



Same conditions, different observed SS

No water stress treatment



# Where are we?

- LEAF model calibration

1. Mastroberardino (2017)

- Aglianico

2. Codorniu (2018)

- Tempranillo

- Chardonnay

3. Symington (2018)

- Touriga Nacional

## Leaf Fall predictions

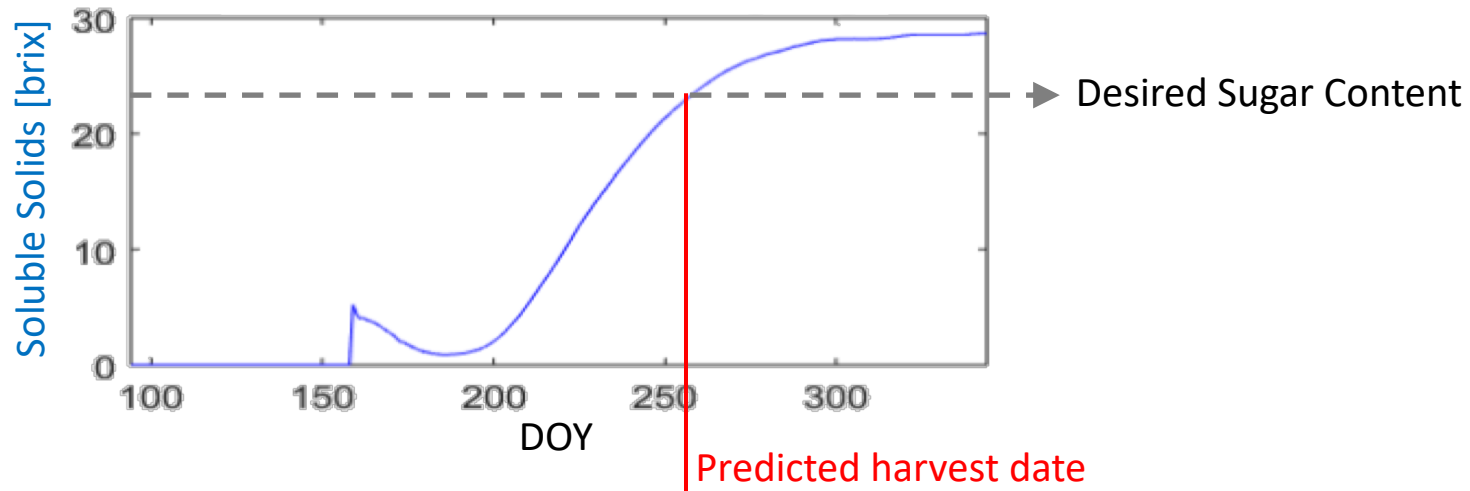
COMPANY	VARIETY	PU_ID	predicted Leaf Fall
Mastroberardino	Aglianico	37	309
Mastroberardino	Aglianico	43	339
Mastroberardino	Aglianico	45	339
Mastroberardino	Aglianico	51	339
Mastroberardino	Aglianico	52	340
Mastroberardino	Aglianico	53	340
Mastroberardino	Aglianico	56	339
Mastroberardino	Aglianico	61	340
Codorniu	Tempranillo	123	319
Codorniu	Tempranillo	124	331
Codorniu	Tempranillo	125	274
Codorniu	Tempranillo	126	331
Codorniu	Tempranillo	114	297
Codorniu	Tempranillo	115	293
Codorniu	Tempranillo	116	295
Codorniu	Tempranillo	117	293
Codorniu	Tempranillo	128	319
Codorniu	Chardonnay	129	263
Codorniu	Chardonnay	130	263
Codorniu	Chardonnay	131	257
Codorniu	Chardonnay	132	257
Symington	TourigaNacional	310	320
Symington	TourigaNacional	312	320
Symington	TourigaNacional	333	320
Symington	TourigaNacional	334	320

...



# Future Work

- Refine calibration and validate
- Predict harvest date





Thank you for you Attention!

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fabrizio.carteni@unina.it

**[www.visca.eu](http://www.visca.eu)**



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# **TASK 2.5**

## **Decadal climatic data**

**2<sup>nd</sup> General Meeting**  
Napoli, 2018 Dec 10<sup>th</sup> – 12<sup>th</sup>

**Josep Maria Solé Tasia**  
Climate Analyst  
Project Manager  
Meteosim, SL · [jmsole@meteosim.com](mailto:jmsole@meteosim.com)



## Summary

- **OBJECTIVE:**
  - To deliver the best climate information at multi-decadal scale (30 years)
- **Delivery date**
  - Month #24 (Jun 2019)
- **Characterization:**
  - Main use: Strategic planning and adaptation decisions for vineyards → Maps.
  - Resolution: Fine scale / decadal
- **Development of the task:**

1. Obtaining and processing the datasets	[COMPLETED]
2. Validation of model data	[ONGOING]
3. Decadal/Seasonal analysis.	[NOT STARTED]
4. Report	[NOT STARTED]

## (1) Obtaining the datasets

### Variables:

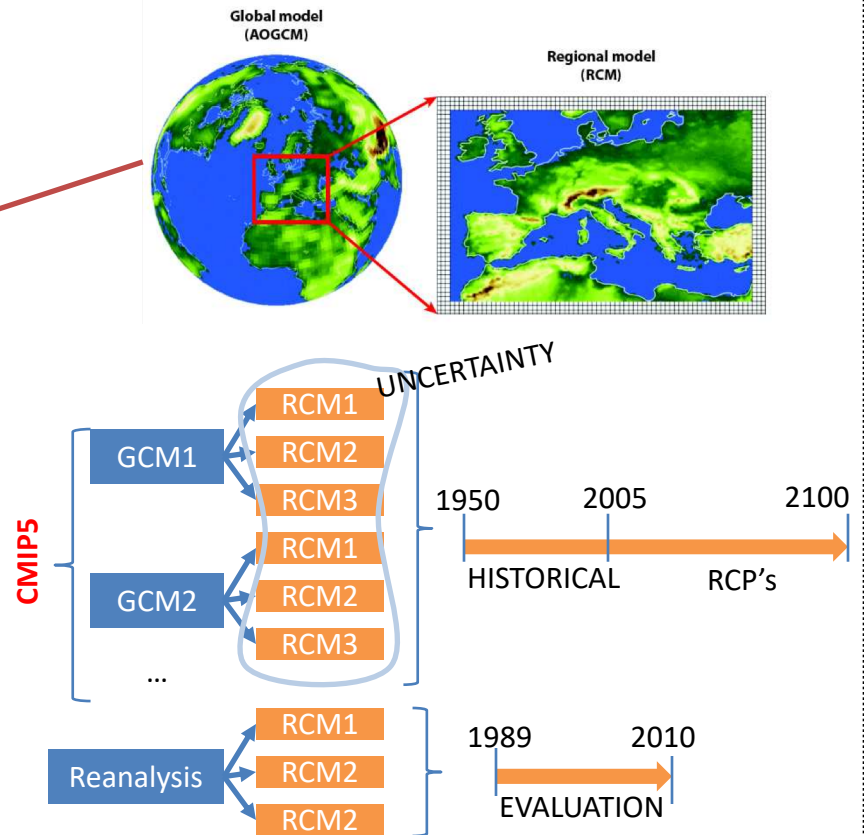
- Mean temperature.
- Max. daily temperature.
- Min. daily temperature.
- Precipitation.

### Model data:

- **EURO-CORDEX** (EUR-11)
- CMIP5 models, **downscaled** at  $0.11^\circ$  rotated pole grid ( $\approx 12.5$  km).
- Daily time resolution
- Experiments:
  - **Evaluation.** Period 1989 – 2011.
  - **Historical.** Period 1950 – 2005.
  - **RCP4.5** (10 members) Period 2006 – 2100
  - **RCP8.5** (9 members) Period 2006 – 2100

### Climate observations:

- **E-OBS** v16.0 Period 1950 – 2016.
- $0.22^\circ$  rotated pole grid.
- Daily time resolution



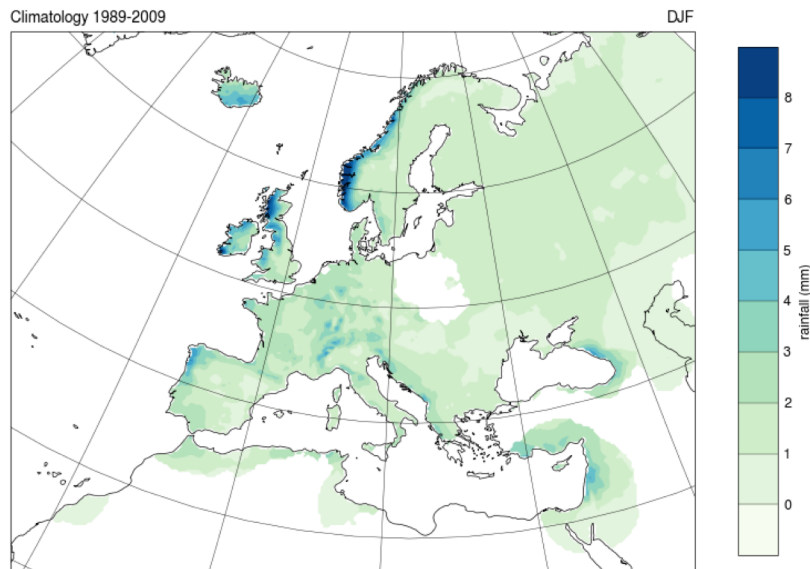
## (2) Validation

- **OBJECTIVE:**
  - To assess whether the models reproduce the current climate → Reliability of projections.
  - By comparing the simulations with gridded observations.
- **Datasets:**
  - Hindcast (ERA-INTERIM + RCM) → Evaluation of the downscaling method.
  - Historical (GCM + RCM) --> Evaluation Global + Downscaling.
- **Validation exercises:**
  - EUR: Spatial patterns of seasonal means (climatology).
  - EUR: Spatial patterns of seasonal trends
  - REG: Annual cycle
  - REG: Seasonal trends
  - Interannual variability

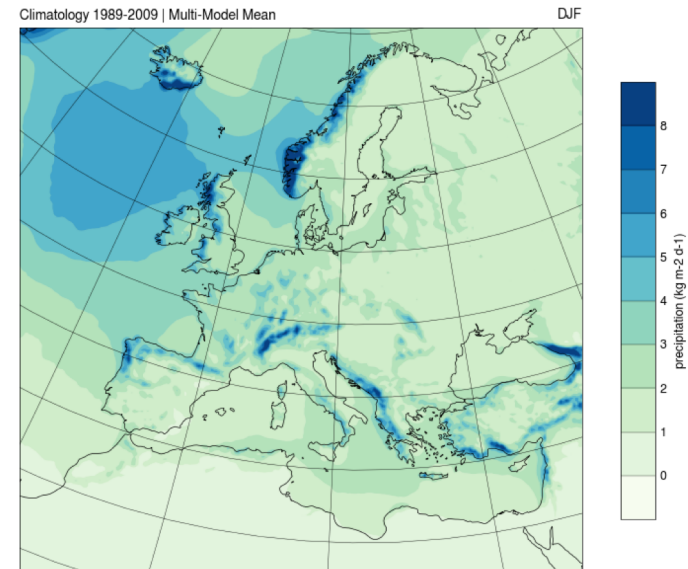
## (2) Validation

- **EUR: European level (PRECIPITATION)**
  - Spatial patterns of seasonal mean

**E-OBS**



**CORDEX-Evaluation (Ens. Mean)**

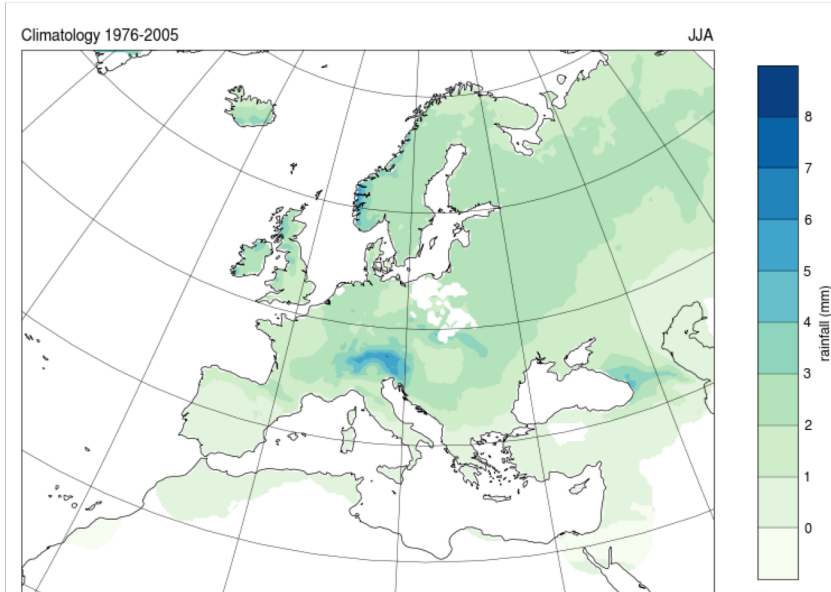




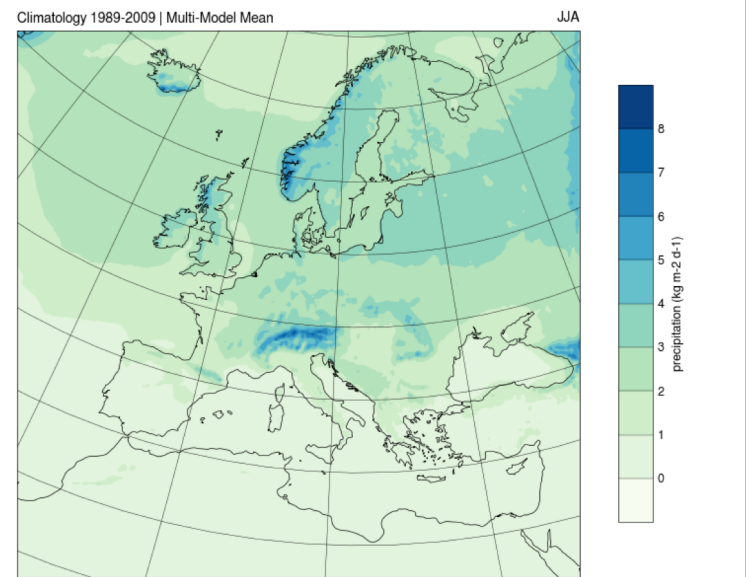
## (2) Validation

- **EUR: European level (PRECIPITATION)**
  - Spatial patterns of seasonal mean

**E-OBS**



**CORDEX-Evaluation (Ens. Mean)**

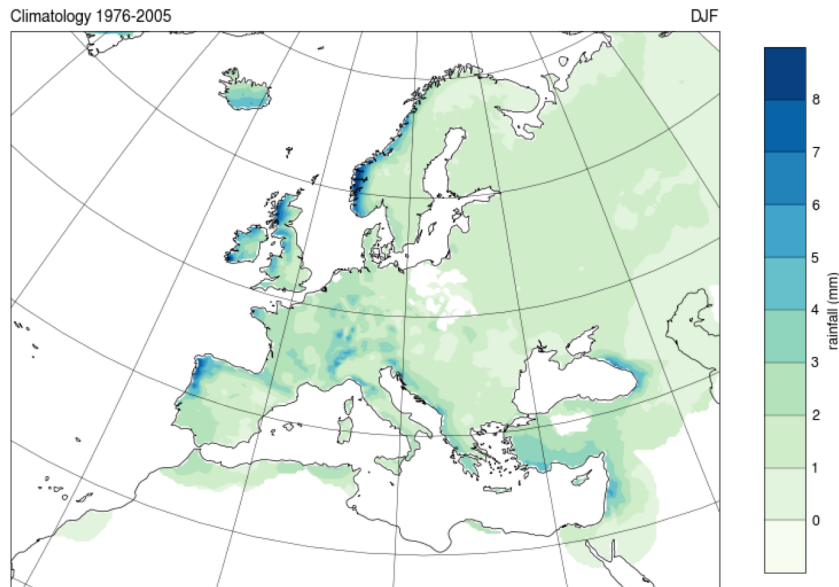




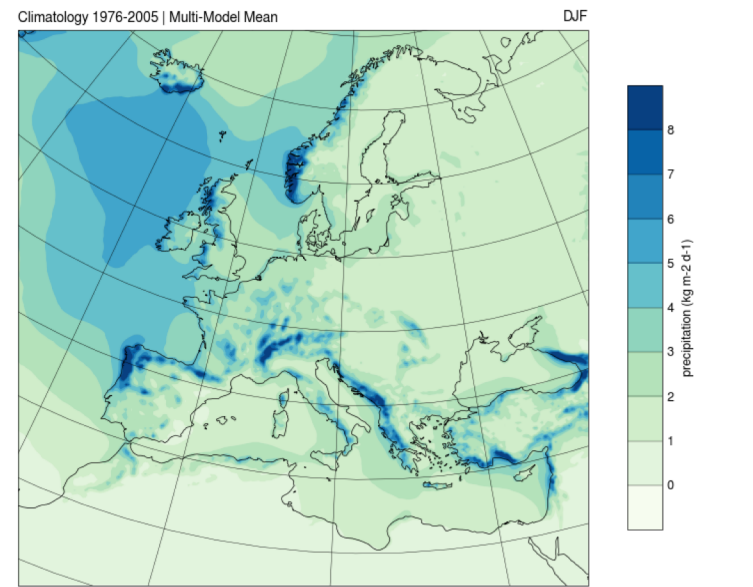
## (2) Validation

- **EUR: European level**
  - Spatial patterns of seasonal mean

**E-OBS**



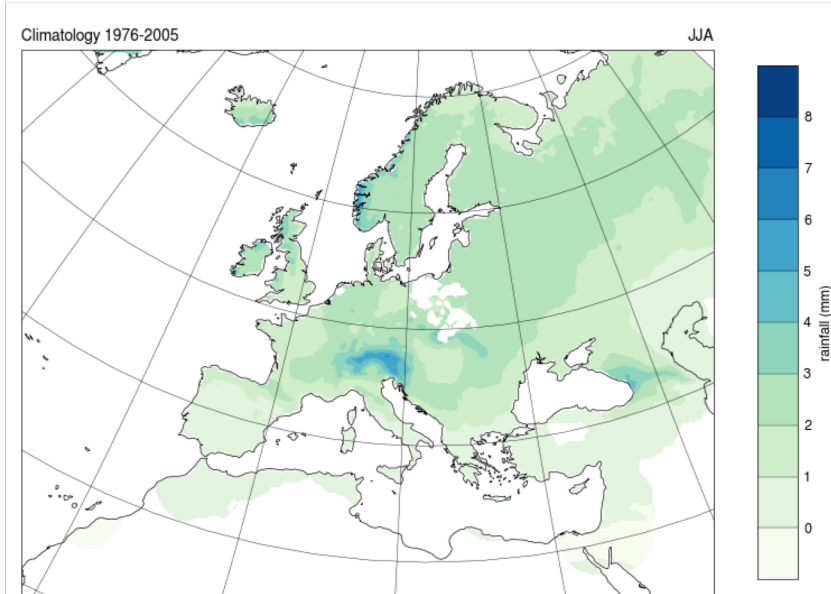
**CORDEX-Historical (Ens. Mean)**



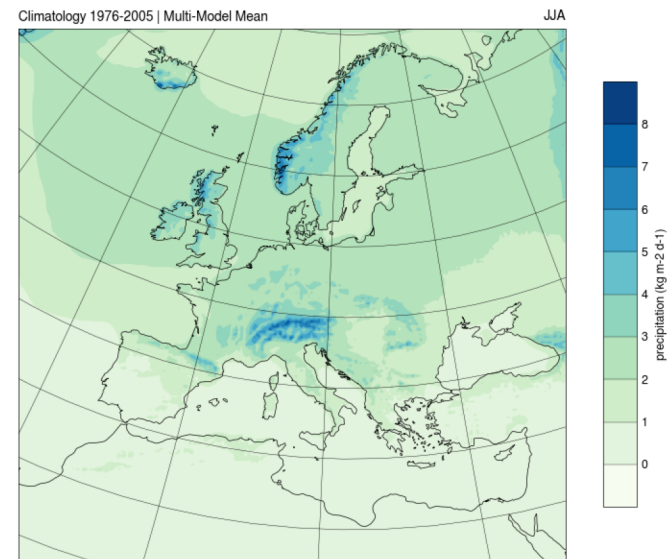
## (2) Validation

- **EUR: European level**
  - Spatial patterns of seasonal mean

**E-OBS**



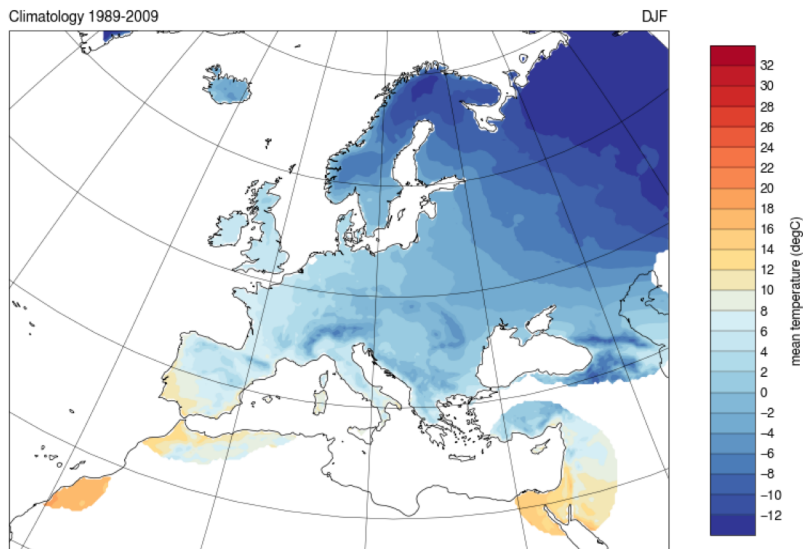
**CORDEX-Historical (Ens. Mean)**



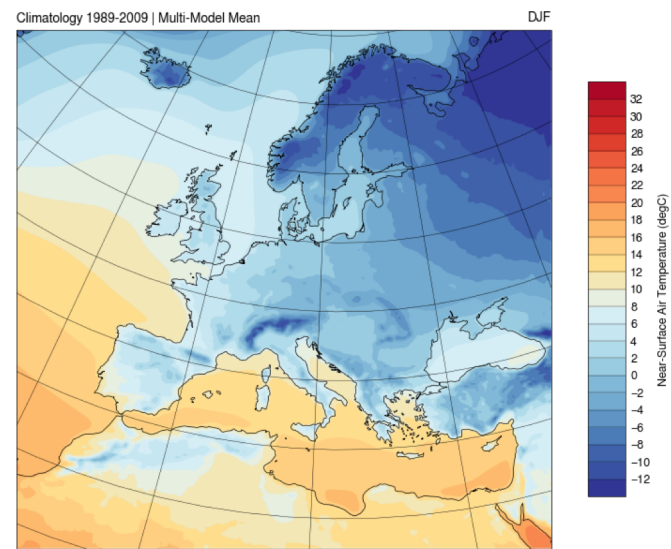
## (2) Validation

- **EUR: European level**
  - Spatial patterns of seasonal mean

**E-OBS**



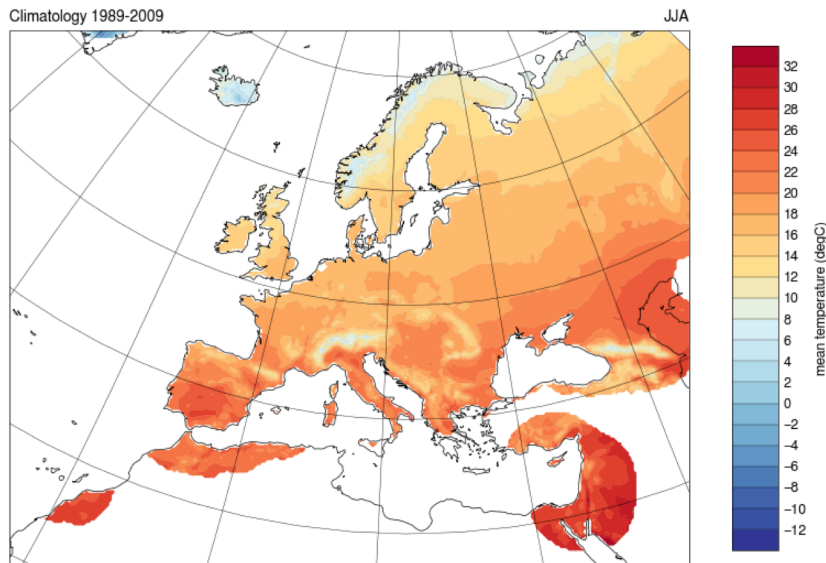
**CORDEX-Evaluation (Ens. Mean)**



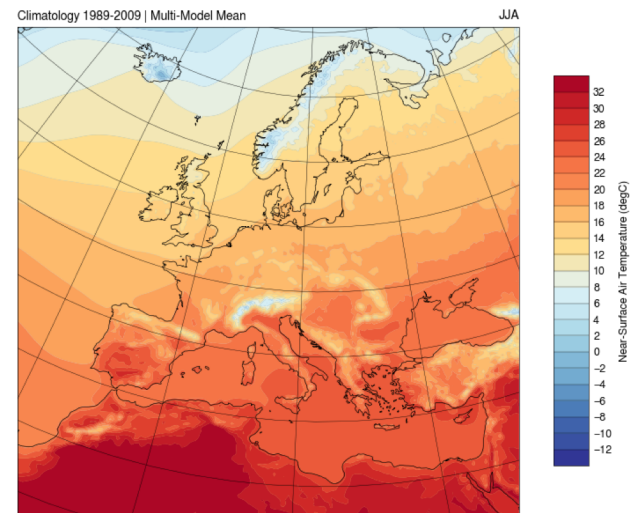
## (2) Validation

- **EUR: European level**
  - Spatial patterns of seasonal mean

**E-OBS**



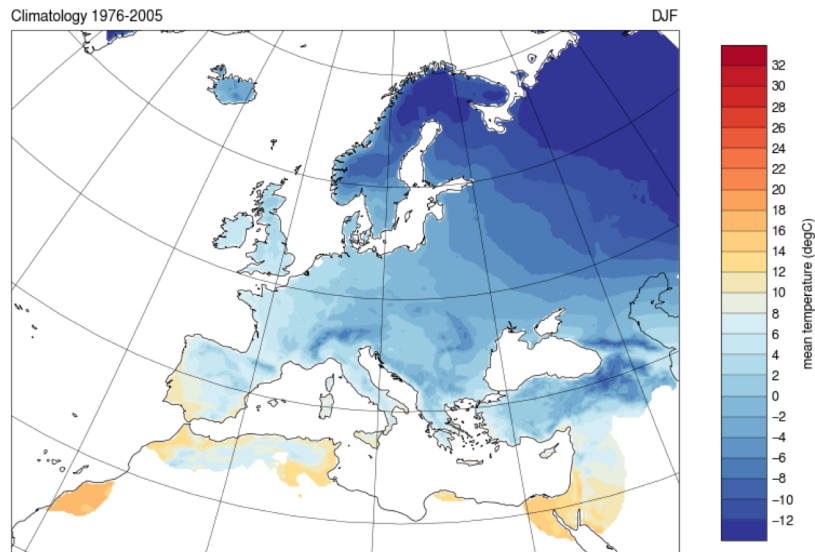
**CORDEX-Evaluation (Ens. Mean)**



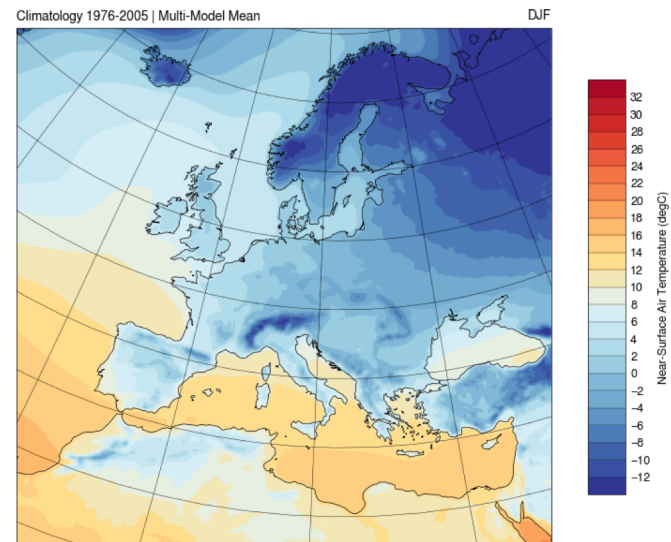
## (2) Validation

- **EUR: European level**
  - Spatial patterns of seasonal mean

**E-OBS**



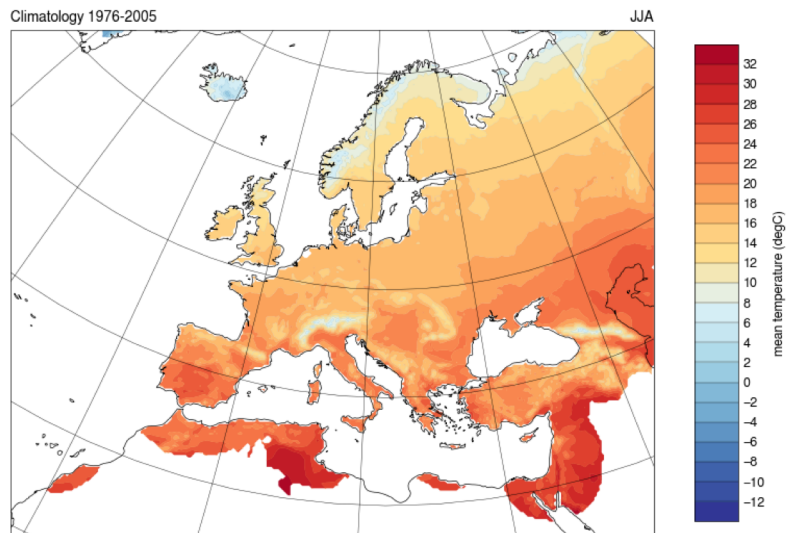
**CORDEX-Historical (Ens. Mean)**



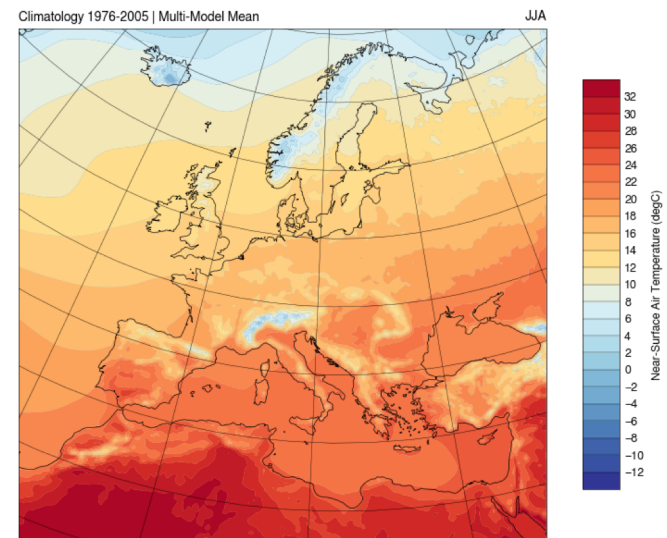
## (2) Validation

- **EUR: European level**
  - Spatial patterns of seasonal mean

**E-OBS**



**CORDEX-Historical (Ens. Mean)**





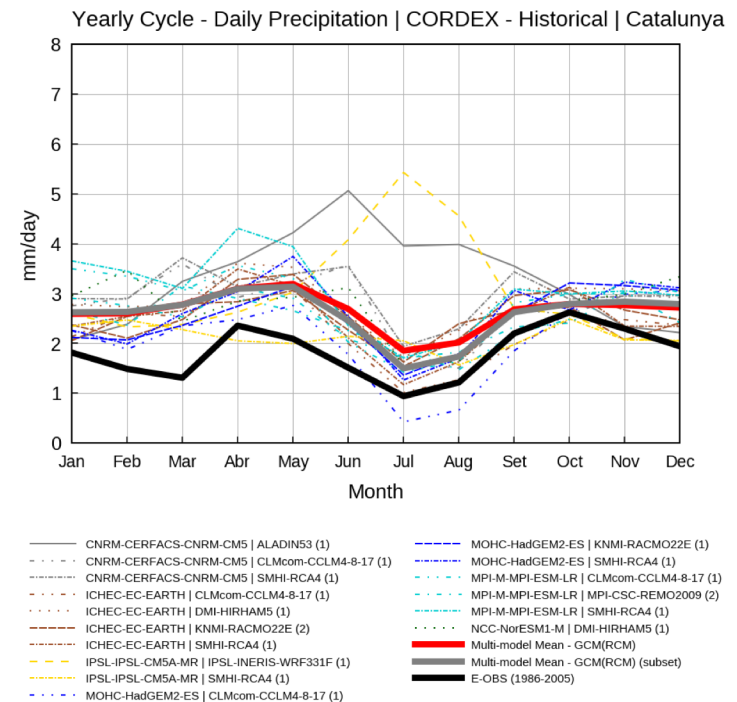
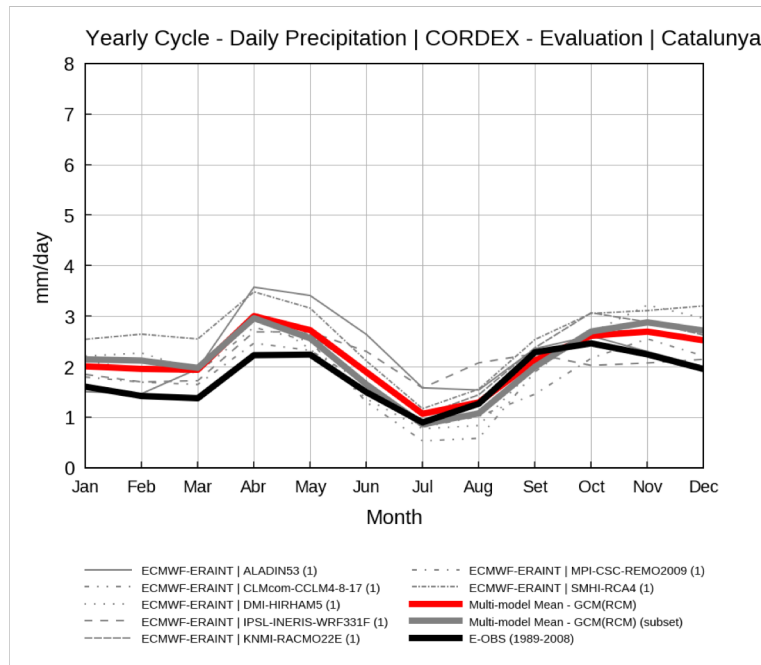
## (2) Validation

- **REG: Regional level (Annual cycle)**



## (2) Validation

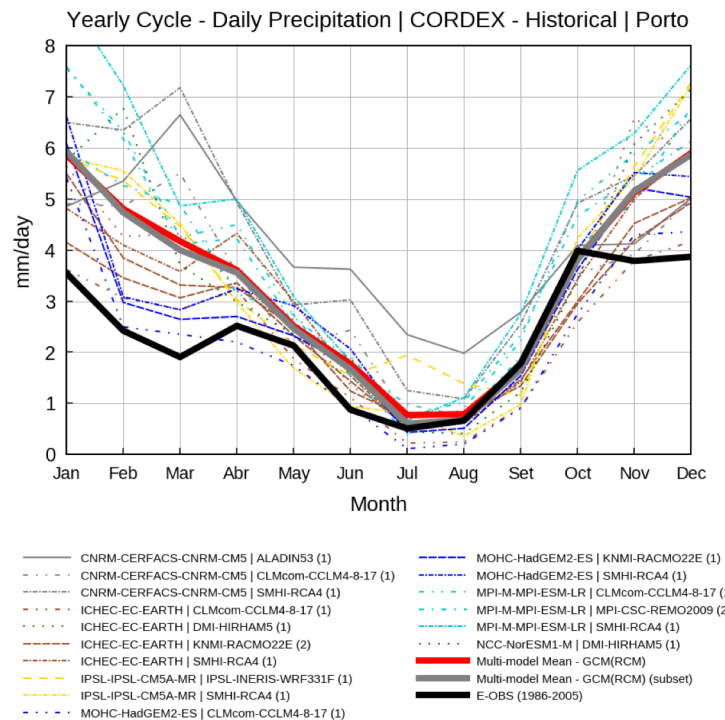
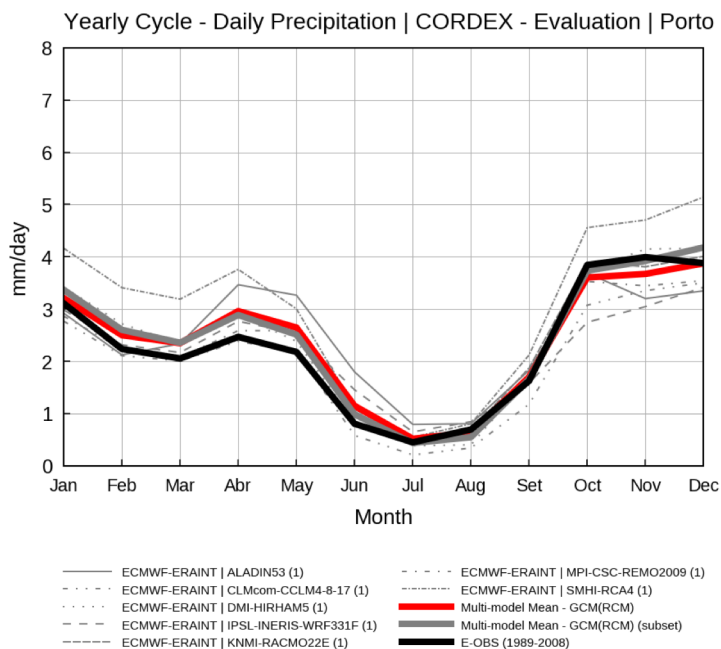
### • REG: Annual cycle - Precipitation - Catalunya





## (2) Validation

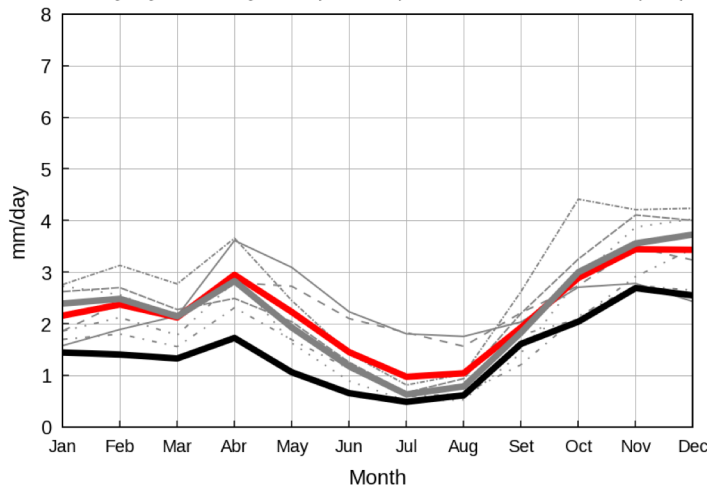
### • REG: Annual cycle - Precipitation - Porto



## (2) Validation

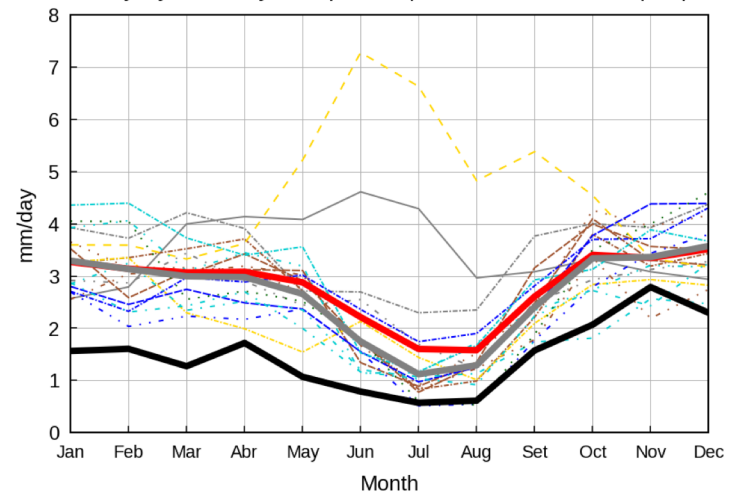
### • REG: Annual cycle - Precipitation - Napoli

Yearly Cycle - Daily Precipitation | CORDEX - Evaluation | Napoli



— ECMWF-ERAINT | ALADIN53 (1)  
 - - - ECMWF-ERAINT | CLMcom-CCLM4-8-17 (1)  
 . . . ECMWF-ERAINT | DMI-HIRHAM5 (1)  
 - - - ECMWF-ERAINT | IPSL-INERIS-WRF331F (1)  
 - - - ECMWF-ERAINT | KNMI-RACMO22E (1)  
 - - - ECMWF-ERAINT | MPI-CSC-REMO2009 (1)  
 - - - ECMWF-ERAINT | SMHI-RCA4 (1)  
 — Multi-model Mean - GCM(RCM)  
 — Multi-model Mean - GCM(RCM) (subset)  
 — E-OBS (1989-2008)

Yearly Cycle - Daily Precipitation | CORDEX - Historical | Napoli

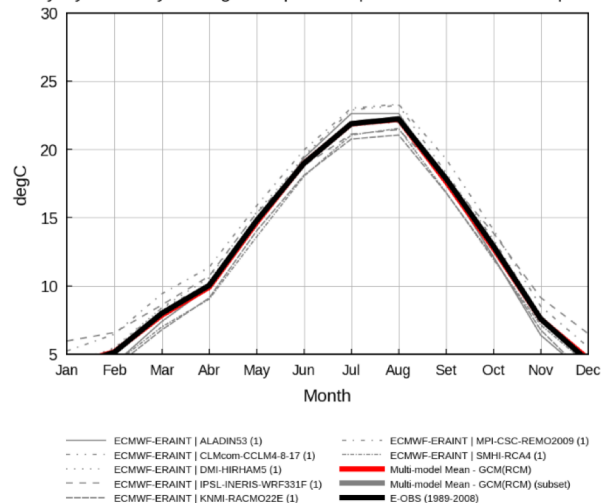


— CNRM-CERFACS-CNRM-CM5 | ALADIN53 (1)  
 - - - CNRM-CERFACS-CNRM-CM5 | CLMcom-CCLM4-8-17 (1)  
 - - - CNRM-CERFACS-CNRM-CM5 | SMHI-RCA4 (1)  
 - - - ICHEC-EC-EARTH | CLMcom-CCLM4-8-17 (1)  
 - - - ICHEC-EC-EARTH | DMI-HIRHAM5 (1)  
 - - - ICHEC-EC-EARTH | KNMI-RACMO22E (2)  
 - - - ICHEC-EC-EARTH | SMHI-RCA4 (1)  
 - - - IPSL-IPSL-CM5A-MR | IPSL-INERIS-WRF331F (1)  
 - - - IPSL-IPSL-CM5A-MR | SMHI-RCA4 (1)  
 - - - MOHC-HadGEM2-ES | CLMcom-CCLM4-8-17 (1)  
 - - - MOHC-HadGEM2-ES | KNMI-RACMO22E (1)  
 - - - MOHC-HadGEM2-ES | SMHI-RCA4 (1)  
 - - - MPI-M-MPI-ESM-LR | CLMcom-CCLM4-8-17 (1)  
 - - - MPI-M-MPI-ESM-LR | MPI-CSC-REMO2009 (2)  
 - - - MPI-M-MPI-ESM-LR | SMHI-RCA4 (1)  
 - - - NCC-NorESM1-M | DMI-HIRHAM5 (1)  
 — Multi-model Mean - GCM(RCM)  
 — Multi-model Mean - GCM(RCM) (subset)  
 — E-OBS (1986-2005)

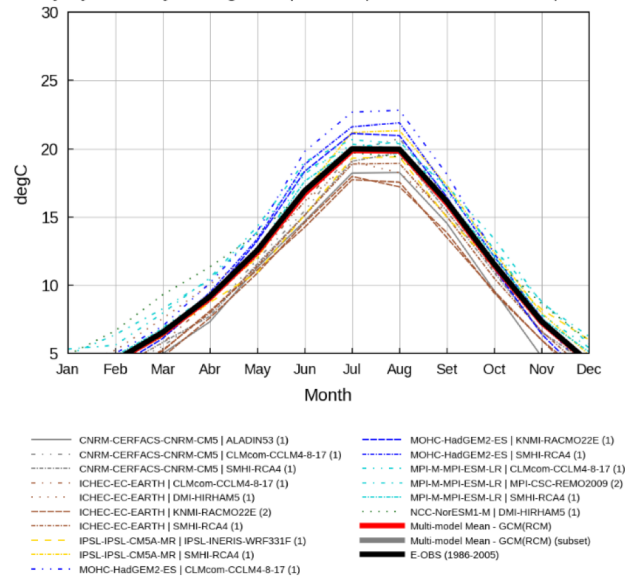
## (2) Validation

- REG: Annual cycle – Temperature - Catalonia**

Yearly Cycle - Daily Average Temperature | CORDEX - Evaluation | Catalunya



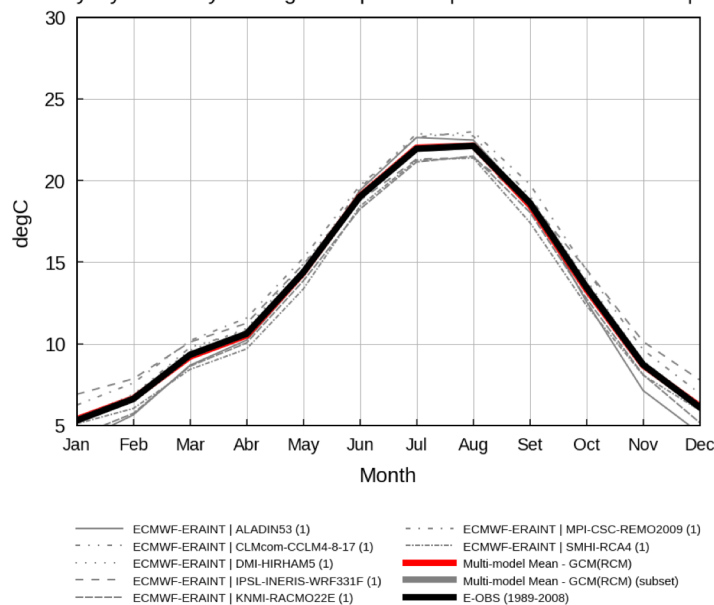
Yearly Cycle - Daily Average Temperature | CORDEX - Historical | Catalunya



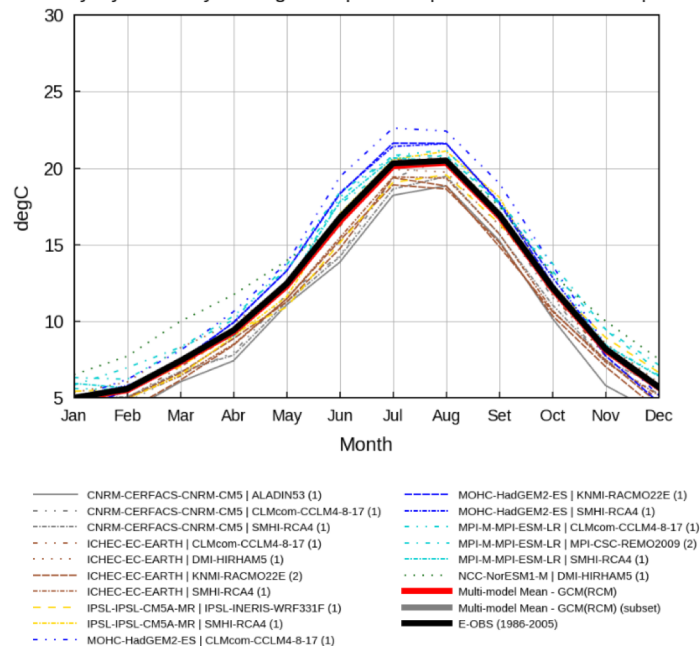
## (2) Validation

### • REG: Regional level – Temperature - Porto

Yearly Cycle - Daily Average Temperature | CORDEX - Evaluation | Porto



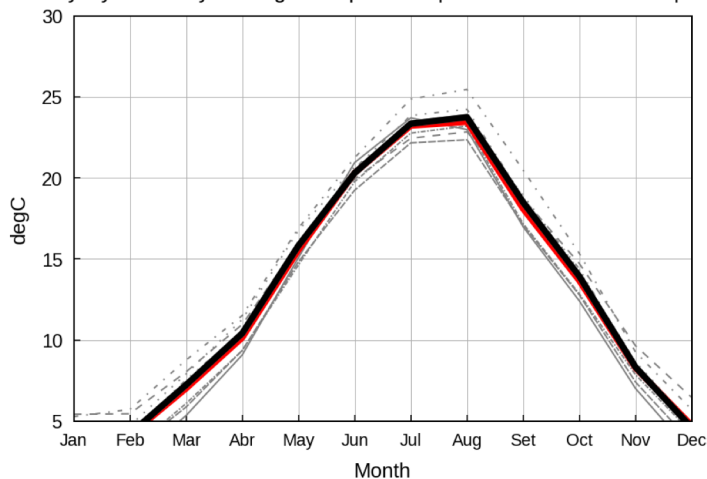
Yearly Cycle - Daily Average Temperature | CORDEX - Historical | Porto



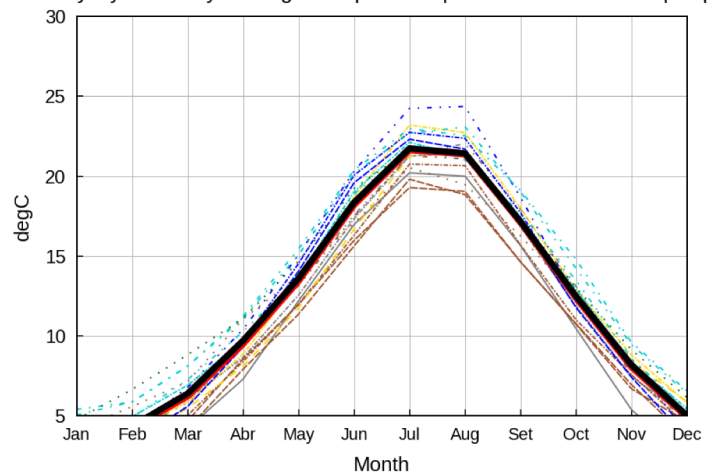
## (2) Validation

### • REG: Regional level – Temperature - Napoli

Yearly Cycle - Daily Average Temperature | CORDEX - Evaluation | Napoli



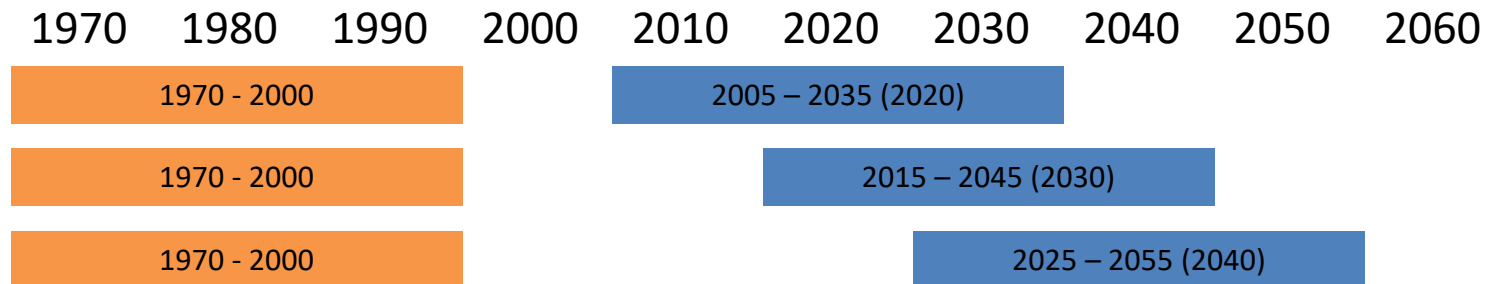
Yearly Cycle - Daily Average Temperature | CORDEX - Historical | Napoli



## (3) Decadal analysis

- Decadal values

- Projected climate minus baseline.
- Trends





Thank you for you Attention!

**Josep Maria Solé Tasia**  
**jmsol@meteosim.com**

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